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VOLUME 11 • JULY 1953 • NUMBER 3 JOURNAL OF ORAL SURGERY

Applied surgical anatomy of the orofacial region

■ *Max H. Jacobs M.D., D.M.D., Boston*

Chemotherapy, treatment with antibiotics and the more rational application of the principles of electrolytes and water balance have decreased the sequelae of serious infections of the jaws, the mouth and the related structures. The advent of anticoagulants, such as heparin and Dicumarol, has served to lower the mortality rate in the treatment of cavernous sinus thrombosis. Nevertheless, because of the increasing number of bacterial strains which show rapidly cumulative evidence of fastness to some of the antibiotics and because of the severe reactions to which some individuals are prone, there are cases in which the spread of infection cannot be controlled and surgical intervention becomes necessary.

Some of the problems of surgical intervention are the mechanical complications arising during the extraction of teeth; the selection of the intraoral approach for the removal of submaxillary and sublingual salivary calculi; the establishment of adequate drainage in the fascial spaces of the neck after serious odontogenic infections; and the determination of the routes of metastatic cervical gland involvement in malignancies of the oral cavity. The solution of these problems requires an accurate knowledge of the anatomic structures in the orofacial region, a knowledge which can be gained only through periodic reviews.

■ *Anatomic Routes to the Cavernous Sinus*

The oral surgeon is concerned with possible involvement of the cavernous sinus, to which infection may spread through at least two principal routes. One route lies within the anterior portion of the face, and the other lies within the infratemporal fossa.

The triangle created by imaginary lines extending from the nasion to the mental foramina has long been known as a danger zone. Since the veins of the head

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and face have no valves, septic emboli may migrate and cause thrombosis in the cavernous sinus (Fig. 1).

The tributaries of the anterior facial vein correspond to the branches of the external maxillary artery. These veins drain the chin, the lips and the external nose and the alae. The angular vein formed by the frontal and supraorbital veins becomes the anterior facial vein on a level with the infraorbital ridge. Since the angular vein communicates with the superior ophthalmic vein through the nasofrontal vein and since the superior ophthalmic vein empties directly into the sinus, there is an anastomosis between the anterior facial vein and the cavernous sinus.

The anterior facial vein is joined also by the buccinator vein, the masseteric vein, the palatine vein, the submental vein, the submaxillary vein and some of the veins surrounding the orbit.

Potential sources of cavernous sinus thrombosis through the anterior facial vein are furuncles and carbuncles of the chin and lips, folliculitis of the nose, acute dentoalveolar abscesses and osteomyelitis of the anterior jaws.

The pterygoid plexus is the second center through which infection may spread to the cavernous sinus. Just as the tributaries of the anterior facial vein correspond to the branches of the external maxillary artery, so do the veins making up the pterygoid plexus correspond to the branches of the internal maxillary artery.

The pterygoid plexus is situated between the temporal muscle and the external pterygoid muscle and partly between the external and internal pterygoid muscles in the lateral portion of the infratemporal fossa. The tributaries of the pterygoid plexus communicate with the cavernous sinus through the foramen ovale, the foramen of Vesalius, the foramen lacerum and the inferior orbital fissure (Fig. 2).

Potential sources of cavernous sinus thrombosis through the pterygoid plexus are infections reaching the upper limit of the pterygomandibular space, osteomyelitis of the posterior part of the maxilla and of the infratemporal surface of the maxillary sinus, acute pericoronitis and acute alveolar abscesses of the maxillary molars.

The pterygoid plexus anastomoses freely with the anterior facial vein through communicating tributaries and the deep facial veins. Thus, posterior infections may reach the cavernous sinus through the anterior facial vein, and anterior infection may reach it through the pterygoid plexus.

■ *The Sublingual Space*

The surgical anatomy of the sublingual space must be considered in the treatment of conditions such as infections from the jaws and teeth; cysts and tumors of the sublingual gland and the upper lobe of the submaxillary gland; salivary calculi within these glands or their ducts; and accidental luxation of teeth or roots into the space.

From above downward, superiorly the lingual space is bounded by the oral mucosa; laterally by the medial surfaces of the mandible above the mylohyoid ridge; posteriorly by the base of the tongue and the hyoid bone; anteriorly by the inner surface of the arch of the mandible; and inferiorly by the mylohyoid and geniohyoid muscles.

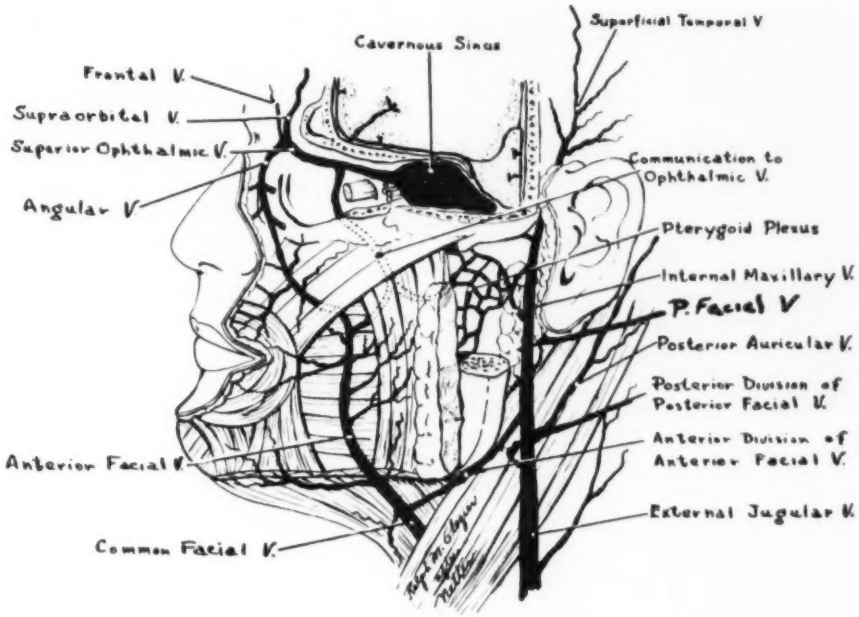

Fig. 1—Venous routes to cavernous sinus

■ *Relation of the Mylohyoid Ridge to the Sublingual Space*

The mylohyoid ridge is the outermost limit of the floor of the sublingual space. Its position on the mandible varies in individuals, being high in some and low in others.

As the mylohyoid ridge approaches the cuspid region, its position on the mandible curves towards the inferior border. Thus, the roots of the posterior teeth may be above or below the ridge, whereas the bicuspid and cuspid roots are almost always above the ridge (Fig. 3).

The lingual surface of the mandible in the third molar region is often extremely thin. A lingually deflected impacted third molar may lie above the mylohyoid ridge when the ridge is low or below it when the ridge is high. When an impacted molar has accidentally been pushed through the lingual plate and the ridge is low, the tooth will lodge either between the posterior portion of the sublingual gland and the upper lobe of the submaxillary gland or entirely on the upper lobe of the submaxillary gland. Since it is within the sublingual space, its extraction offers no problem. In such an instance, the lingual mucosa is reflected and retracted; the molar then can be seen lying on the mylohyoid muscle and is removed without difficulty.

When the ridge is high, the tooth

Fig. 2—Skull showing foramina through which pterygoid plexus may communicate with cavernous sinus; 1, inferior orbital fissure; 2, foramen ovale; 3, foramen lacerum

may be pushed through the bone below the mylohyoid muscle and may lodge in the upper part of the submaxillary triangle. Between the mylohyoid muscle and the hyoglossus and genioglossus muscles is the intermuscular region through which the lingual nerve, the hypoglossal nerve and its accompanying vein and also the upper lobe of the submaxillary gland and its duct enter the sublingual space. An attempt to remove a tooth from this region blindly may cause injury to one or more of these structures.

Therefore, if an impacted mandibular third molar has been pushed through the lingual plate, if the mylohyoid ridge is high and if the tooth lies in the submaxillary triangle, it is necessary to strip the attachment of the mylohyoid muscle from the ridge in order to remove the tooth without causing hemorrhage and injury to the underlying structures.

The primary incision for the removal of such a tooth is made over the anterior ridge of the vertical ramus to the distal surface of the second molar and extended through the lingual surfaces of the interdental papillae to the second bicuspid. The mucosa (not the mucoperiosteum) is reflected and retracted, and the exposed attachment of the mylohyoid muscle is stripped from the periosteum. The muscle is then retracted, and the contents of the upper part of the submaxillary triangle are exposed under direct light. The luxated tooth can be seen easily and removed without injury to any of the structures.

■ *Mental Spines*

Abnormally large, long and fused mental spines (geniotubercles) create difficulty in denture construction, especially when the mandible has atrophied considerably. Surgical excision of the spines may become necessary. Attached to them superiorly are the genioglossus

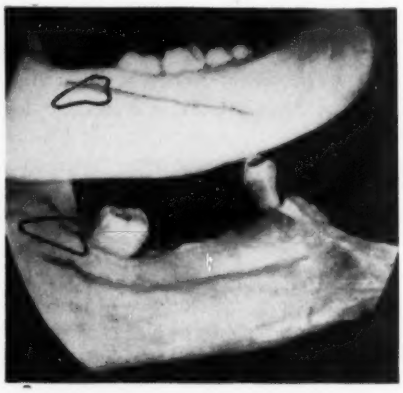

Fig. 3—Variations in position of mylohyoid ridge

muscles and inferiorly the geniohyoid muscles.

The geniohyoid muscles lie on the mylohyoid muscles and are inserted on the anterior surface of the hyoid bone. The inferior fibers of the genioglossus muscles are inserted into the upper part of the body of the hyoid bone; the middle fibers pass backward into the under surface of the tongue along its entire length, and the superior ones pass upward and forward to the tip (Fig. 4).

When the mental spines are excised together with the attachments of these muscles, there is a resulting change in the position of the hyoid bone and an upward and backward displacement of the tongue. It would seem to be necessary, therefore, to detach these muscles from the spines and to provide below the excised spines a suitable periosteal base to which the tendons may be sutured.

Practically, this detachment is not necessary, since only the geniohyoid muscles and the inferior fibers of the genioglossus muscles are attached to the hyoid bone. The other fibers of the genioglossus muscles are inserted into the tongue. Anatomically, a permanent change in the position of the hyoid bone does not occur, since it is stabilized by the digastric muscle.

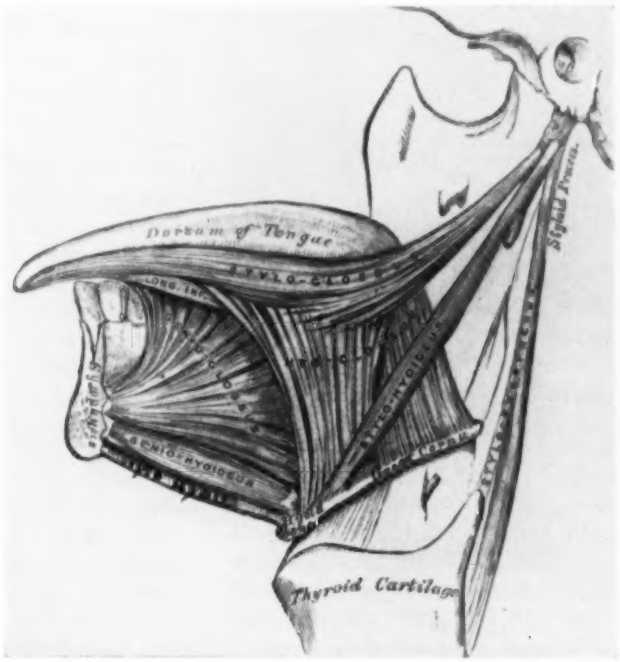

Fig. 4—Direction of fibers of genioglossus muscles. (Gray's Anatomy, ed. 23. Courtesy Lea and Febiger)

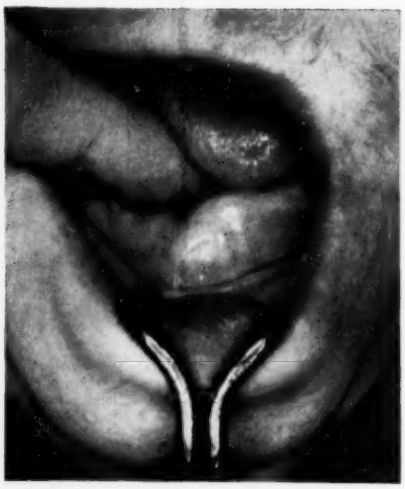

Fig. 5—Mental spines simulating bony tumor

Figure 5 shows a case of an atrophic mandible with extremely long and fused mental spines. The spines, large enough to simulate a bony growth on the anterior lingual surface of the mandible, presented a serious problem in the construction of a denture.

After a local anesthetic was administered to the patient, the mental spines were exposed; and the muscular attachments were stripped off. The tongue could be seen moving slightly upward and backward for a moment and then returning to its normal position as a result of the stabilizing effect of the digastric muscle. The spines were excised with chisel and mallet, and the bone was smoothed with bone files. The lingual mucosa was replaced and sutured. At no time did the patient complain of any untoward effect on the position or action of the tongue.

■ *The Submaxillary Duct*

Lying slightly lateral to the margin of the tongue is a fold of mucosa called the plica sublingualis. This tissue is an important landmark. It lies over the anterior portion of the submaxillary (Wharton) duct.

Clinically, the direction of the duct as it lies within the floor of the mouth is best illustrated by a roentgenogram of a long calculus in the submaxillary duct (Fig. 6, above).

The duct of Bartholin empties from the sublingual gland into the submaxillary duct. Emptying also from the sublingual gland are from eight to 20 ducts, collectively termed the ducts of Rivinus, some of which join to form the duct of Bartholin and some of which empty directly into the mouth, others into the plica sublingualis. The submaxillary duct empties into the mouth through an orifice in the anterior extremity of the plica, called the caruncula sublingualis.

Lying on the mylohyoid muscle in a depression on the medial surface of the body of the mandible and extending from below the roots of the incisors to about the second or third molar region is the sublingual gland. Posterior to this gland is the upper or oral lobe of the submaxillary gland, jutting into the sublingual space from behind the posterior free margin of the mylohyoid muscle (Fig. 6, below).

Projecting from the upper lobe of the submaxillary gland is the submaxillary duct, passing forward between the mylohyoid muscle and the hyoglossus and the genioglossus muscles and continuing between the sublingual gland and the genioglossus muscle to become more superficial and lie under the plica sublingualis.

A number of structures enter the sublingual space from between the posterior free border of the mylohyoid muscle and the hyoglossus and the genioglossus muscles: the upper lobe of the submaxillary gland and its duct, the lingual nerve and the chorda tympani within its sheath, the hypoglossal nerve and an accompanying vein. Beck[1] regards this particular region as an intermuscular opening through which pus can travel from the sublingual space into the neck.

On the lateral surface of the hyoglossus muscle, the submaxillary duct lies between the lingual and hypoglossal nerves. At the anterior border of the hyoglossus muscle, the lingual nerve crosses the duct and runs superficially along the tongue to its tip. The hypoglossal nerve leaves the anterior border of the hyoglossus muscle to enter the fibers of the genioglossus muscle. The lingual nerve and submaxillary duct separate the sublingual gland from the genioglossus muscle.

As the lingual nerve passes over the upper lobe of the submaxillary gland, it lies close to the upper part of the inner surface of the angle of the mandible. It is at this point that the submaxillary ganglion is suspended from the lingual nerve.

Lipomas, cysts and mixed cell tumors within the sublingual space are not uncommon. Lipomas may occur within or on the sublingual and submaxillary glands or in the connective tissue. The primary line of incision for their removal is important. To avoid injury to the submaxillary or Bartholin ducts, the incision must not be made over the plica sublingualis.

Cysts in the floor of the mouth are of three types: those which arise within the mucous glands, those which arise within the salivary glands or their ducts, and those which arise within the connective tissue of the sublingual space.

A mucocele, involving a mucous gland, is superficial; and its excision involves no important structure. A ranula, involving the sublingual gland or one of

1. Beck, A. L. Deep neck infection. Ann. Otol., Rhin. & Laryng. 56:439 June; 56:722 Sept. 1947.

Fig. 6—Above: Direction of submaxillary duct illustrated by a long calculus in submaxillary duct. Below: Position of oral lobe of submaxillary gland illustrated by a large submaxillary calculus

its ducts, may be large enough to be in direct contact with the lingual nerve or lingual blood vessels. If excision is attempted, these structures must be avoided. The cystic membrane of the ranula is usually extremely thin and easily ruptured, so that its complete removal is rather difficult. For this reason marsupialization is most often performed.

The dermoid cyst, which arises frequently in the anterior part of the sublingual space, has a dense sac. Its contents, which may be hair, bone or other structures, and its fluid of high specific gravity make it heavy enough to cause pressure atrophy of the muscles of the floor of the mouth with a sagging or rupture into the suprahyoid (submental) triangle. Such a result is especially likely when the median fibrous raphe is congenitally missing.

■ *Suprahyoid Space*

The suprahyoid triangle is formed posteriorly by the anterior belly of the digastric muscle, anteriorly by the midline of the neck from the mandible to the hyoid bone, inferiorly by the hyoid bone and lastly by the mylohyoid muscle as its floor. Its contents are one or two lymph nodes and a few small veins which unite to aid in forming the anterior jugular vein. The suprahyoid triangle is regarded as the safe triangle of the neck since no important structures are within this region; therefore, an external approach for the removal of a dermoid cyst is uncomplicated.

■ *Infections Within the Sublingual Space*

The question has often arisen as to why certain infections within the floor of the mouth tend to remain unilateral, while others tend to fulminate immediately into a bilateral involvement. Dissections make the reason evident.

The sublingual space is not a single space but consists of three spaces, two superior spaces lying between the oral mucosa and the geniohyoid muscles and separated from each other by the genioglossus muscles and one inferior space lying between the geniohyoid muscles and the mylohyoid muscles.

In an anatomic dissection, if a finger is placed between the oral mucosa and the geniohyoid muscle on one side, it is difficult to enter on the other side because of the firm fascial attachment in the midline formed horizontally by the fasciae of the geniohyoid muscles and vertically by the genioglossus muscles.

If a finger is placed between the geniohyoid muscle and the mylohyoid muscle on one side, however, the fascial attachment can easily be swept to the other side with no obstruction in its course, since there is no septum dividing the space between the geniohyoid muscles and the mylohyoid muscles.

It must be remembered, however, that the geniohyoid muscles are narrow, ribbonlike muscles and do not extend to the inner surfaces of the mandible as do the mylohyoid muscles and the oral mucosa. Therefore, infection may tend to be confined to one side of the upper space or pass immediately to the lower space and become bilateral.

When infection is bilateral, it spreads posteriorly through the connective tissue and between the muscle fasciae as far as the posterior borders of the mylohyoid muscles. At this point the base of

the tongue becomes involved and is displaced upward, the glottis becomes edematous and respiratory embarrassment ensues. This type of infection is complete, bilateral sublingual cellulitis, or Ludwig's angina. Early incision and drainage are mandatory. Success or failure depends on the making of an incision through which the fascial planes can be explored and the direct seat of the infection can be determined, if it is possible. The usual incision is made transversely below the chin through the skin, the superficial fascia and the platysma. The superficial layer of the deep cervical fascia is incised to provide access to the mylohyoid muscles, which are spread by blunt dissection; and the upper and lower parts of the sublingual space are explored with the finger. Thus an abscess cavity can be reached, and drainage can be established. When indicated, bilateral accessory incisions below the lateral borders of the mandible can be made, and the sublingual space can be entered on each side for further avenues of drainage. If drainage is not established early enough, infection of a fulminating type may rupture through the intermuscular space at the junction of the mylohyoid, hyoglossus and geniohyoid muscles into the pharyngomaxillary space.

■ *Pterygomandibular Space*

A knowledge of the relation of the anatomic structures within the pterygomandibular space is important to secure anesthesia of the inferior alveolar nerve: (1) for resection of this nerve and the lingual nerve (or both) to ease intractable pain, (2) for the removal of broken needles and (3) for ligation of the inferior alveolar blood vessels in case of aneurysm or cavernous hemangioma of the mandible.

The superior boundary of the space is the external pterygoid muscle, which extends, by an upper head, from the lower part of the lateral surface of the greater wing of the sphenoid and from the infratemporal crest and, by a lower head, from the lateral surface of the lateral pterygoid plate to the front of the neck of the condyle and to the anterior margin of the meniscus of the temporomandibular joint.

The medial boundary of the space is the internal pterygoid muscle, which extends from the medial surface of the lateral pterygoid plate of the sphenoid and the tuberosity of the maxilla to the posterior inner surface of the ramus and the angle of the mandible below the mandibular foramen. The lateral boundary of the space is the medial surface of the vertical ramus of the mandible. These boundaries create a space with its apex in a medial position and its base in a lateral position (Fig. 7, left).

Covering the anterior border of the ramus are the fibers and tendon of the temporal muscle, which in some individuals extend to the distal surface of the third molar.

Extending from the angular spine of the sphenoid to the lingula and passing through this space is the sphenomandibular ligament (Fig. 7, right). It is important to remember that the first or mandibular portion of the internal maxillary artery passes between the ramus of the mandible and the sphenomandibular ligament, runs along the lower border of the external pterygoid muscle, and after becoming the second or pterygoid portion of the artery, passes between the two

heads of the external pterygoid muscle and becomes the third or pterygopalatine portion to enter the pterygopalatine fossa.

Converging in the area of the mandibular foramen are the tendon from the internal pterygoid below the foramen and the sphenomandibular ligament above it. Calcification of these structures is one of the common causes for the fracturing of needles during attempts to anesthetize the inferior alveolar nerve.

To expose the contents of the pterygomandibular space, the primary incision is made through the mucosa over the anterior ridge of the ramus of the mandible from the coronoid process to the retromolar triangle; the incision is extended through the lingual aspect of the interdental papillae to the second molar. Reflection and retraction of the mucosa medially expose the tendon of the temporal muscle on the anterior border of the ramus and the tendon of the internal pterygoid muscle on the medial surface.

The tendons and fibers of the internal pterygoid muscle are recognized by their oblique direction as they enter the points of insertion. The tendon and fibers of the temporal muscle are recognized by their vertical direction. By retraction of the fibers of the internal pterygoid muscle, the lingula and inferior alveolar foramen can be exposed.

The inferior alveolar nerve can be seen passing between the sphenomandibular ligament and the medial surface of the ramus and entering the mandibular canal. Medial and anterior to this nerve, the lingual nerve can be seen between the internal pterygoid muscle and the ramus of the mandible, crossing obliquely to the side of the tongue over the lateral surface of the constrictor pharyngis superior muscle and the styloglossus muscle. The nerve then lies between the hyoglossus muscle and the upper lobe of the submaxillary gland and crosses the submaxillary duct to enter the tongue. Since the lingual nerve lies between the hyoglossus muscle and the upper lobe of the submaxillary gland, it is in a position where it can be injured easily during operations on the posterior lingual surface of the body of the mandible.

Accompanying the inferior alveolar nerve are the inferior alveolar vein and artery, the pulsation of which can be felt with a finger. After this exposure has been completed, evulsion and section of the inferior alveolar nerve or injection of the nerve trunk with alcohol and the ligation of the inferior alveolar artery can be accomplished. If interference with the sensory nerve supply to part of the tongue is desired at the same time, the lingual nerve can be picked up just anteriorly and medially to the inferior alveolar nerve before it enters the canal.

The pterygomandibular space is important from the standpoint of such infections as acute pericoronitis, infection secondary to injection, infections of hematomas and infection following extraction of a mandibular third molar. Posterior to this space lies the lower or retromandibular lobe of the parotid gland covering a portion of the inner and outer surface of the angle of the ramus. It is separated from the submaxillary gland by the deep layer of the deep cervical fascia which forms the stylomandibular ligament and capsules of these glands.

The inner surface of the retromandibular lobe of the parotid gland may have

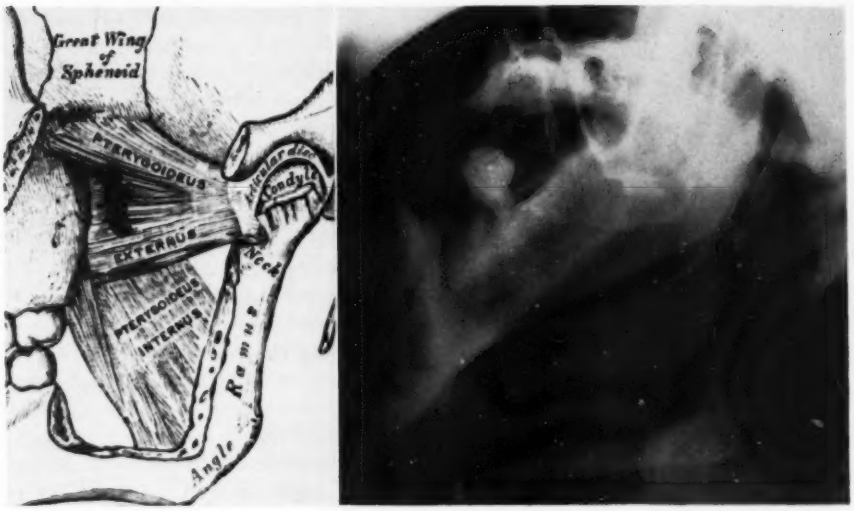

Fig. 7—Left: Boundaries of pterygomandibular space. (Gray's Anatomy, *ed. 23. Courtesy Lea and Febiger.*) *Right: Calcified sphenomandibular ligament within pterygomandibular space*

a very thin or no fascial covering, and infection of this lobe may follow extension of infection from the pterygomandibular space. Infection in this space or in the parotid gland may directly involve the pharyngomaxillary space.

■ *Lymph Structures*

The anatomic arrangements of the lymph glands and channels in the mouth and neck are important in the study of extension of infection and malignant metastasis. Clinically, the site, size and discreteness or matting of lymph nodes may be clues in differential diagnosis.

Barnhill's[2] description of the submandibular lymph glands as a necklace and pendants simplifies an understanding of their location (Fig. 8). The necklace is a horizontal arrangement of the lymph nodes below the jaw and is composed of the submental and submaxillary nodes. The pendants are two chains of nodes on each side of the neck; one, superficial, lying on the sternomastoid muscle, parallel with the external jugular vein; and the other deep, lying on the ventral surface of the carotid sheath in association with the internal jugular vein. The deep cervical nodes are further divided into the superior nodes, which are under the sternomastoid muscle, and the inferior deep cervical lymph nodes, which extend beyond the posterior border of the sternomastoid muscle into the supraclavicular triangle.

2. Barnhill, John Finch, and Mellinger, William J. Surgical anatomy of the head and neck, ed. 2. Baltimore, Williams & Wilkins Co., 1940, p. 32.

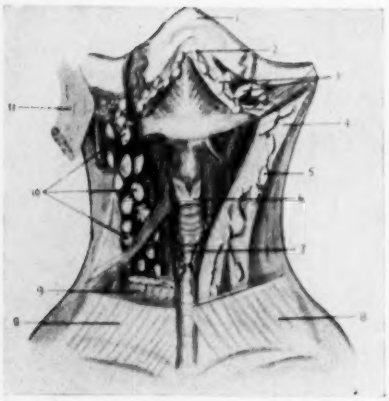

Fig. 8—Arrangement of cervical lymph nodes in chain and pendant form; 1, mandible; 2, submental lymph nodes; 3, submaxillary lymph nodes; 4, sternomastoid muscle; 5, superficial cervical lymph nodes; 6, larynx; 7, isthmus of thyroid gland; 8, platysma muscle; 9, cut end of sternomastoid muscle; 10, deep cervical lymph nodes—the pendants; 11, cut end of sternomastoid muscle. (Barnhill, Surgical Anatomy of the Head and Neck, *ed. 2. Courtesy of Williams and Wilkins Co.)*

There are certain nodes which are of special interest to the oral surgeon. The parotid nodes are composed of three groups: (1) a subparotid group lying on the lateral wall of the pharynx, (2) two or three nodes in the substance of the parotid gland, (3) two or three small nodes lying in the subcutaneous tissue over the gland.

There are one or two nodes over the bifurcation of the common carotid artery which drain the tongue directly through lymph channels. These are known as the lingual lymph nodes.

There is a gland, the gland of Stahr, lying over the external maxillary artery at the point where the artery crosses over the mandible; this gland often becomes palpable after infections of the mandible or of the teeth and remains so.

Almost all the nodes of the face and mouth drain into the superior deep cervical glands, from which drainage enters into the inferior deep cervical glands and thence into the thoracic duct on the left and the lymphatic duct on the right.

The sublingual space is abundantly supplied with lymph vessels; and since there is no longitudinal septum between the geniohyoid muscles and the mylohyoid muscles, metastasis from a lesion on one side may involve not only the lymph glands on the same side but also at times those on the other side.

Infections of the tip of the tongue, of the anterior floor of the mouth and of the anterior mandibular teeth drain into the nodes of the suprahyoid triangle; one of these nodes once infected may remain palpable for many years. Such an enlarged lymph node must be differentiated from a thyroglossal cyst or a dermoid cyst, which may occur in the same area.

■ *Pharyngomaxillary Space*

Infections from the mouth, sinuses and throat may reach and involve the pharyngomaxillary space. This anatomical space has been termed by various authors as lateral pharyngeal, peripharyngeal and parapharyngeal. There is a marked divergence of opinion in descriptions of the boundaries of this space. Barnhill[2] states that he, Hall and Mellinger dissected this space at the same time and that "when finished, each came to slightly different conclusions."

A brief description of the cervical fascia reveals the reason for confusion. If the fascia is considered as an envelope

within an envelope surrounding the neck, the outer envelope is the superficial fascia. The inner or deep envelope may then be considered as composed of two layers, a superficial and a deep one, the latter created by a splitting of the superficial layer of the deep fascia to aid in the complete covering of the individual structures within the neck and face.

There are a number of processes or alae extending from the deep fascia. These processes bind down the omohyoid muscle to the sternum; they form the greater part of the carotid sheath which encloses the common carotid artery, the internal jugular vein and the vagus nerve; in addition they form the prevertebral process or fascia which aids in the formation of the carotid sheath and also in the formation of a sheath within which are contained the viscera of the neck.

From this prevertebral fascia extends a thin sheath, the buccopharyngeal fascia, which invests the constrictor muscles of the pharynx and continues from the constrictor pharyngis superioris muscle over the buccinator muscle.

At the junction of the superior constrictor muscle and the buccinator muscle the fascia thickens; this thickened fascia, called the pterygomandibular raphe or ligament, is the most anterior limit of the pharyngomaxillary space. The formation of the carotid sheath is completed by an ala called the pretracheal fascia.

Between the fascial layers, loose connective tissue, lymph nodes, nerves and blood vessels may be found. Separation of the fascial planes by a finger creates a space which is termed an anatomic space. Pus within some of the fascial spaces may travel upward to the base of the skull and downward to the mediastinum, since in places the fascia is attached to the skull and inferiorly to the clavicle, the acromion and the sternum.

The superficial layer of the deep cervical fascia also is attached to the lower border of the mandible, where it splits, the outer layer covering the parotid gland and masseter muscle and becoming attached to the lower border of the zygoma. The inner layer invests the inner aspect of the parotid gland and is adjacent to the pharyngomaxillary space.

The fascia covering the outer aspect of the parotid gland is called the parotideomasseteric fascia. It is very thick, and infection within the parotid gland finds difficulty in breaking through the fascia. The layer of fascia covering the inner aspect of the parotid gland is very thin and in places may be missing, especially over the retromandibular lobe. From this area, pus may rupture into the pharyngomaxillary space.

What may be considered a complex entity is clarified for the oral surgeon by a modification and combination of the description Beck[1] made of the space with a description Hall[3] made of the boundaries of that space.

The pharyngomaxillary space is cone-shaped (Fig. 9). Its superior boundary is the base of the skull. Its inferior boundary or apex is the hyoid bone. The medial boundary is the buccopharyngeal fascia and the constrictor pharyngis superior muscle, which separates the pharyngomaxillary space from the tonsillar space. The lateral boundary consists of the ramus of the mandible, the internal

3. Hall, C. The what and why of the pharyngomaxillary space. Dis. Eye, Ear, Nose & Throat. 1:203 July 1941.

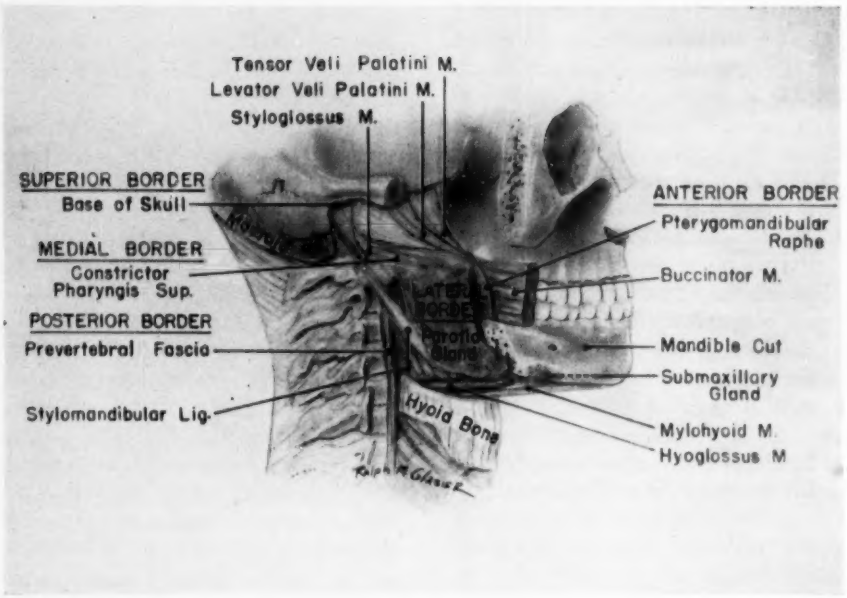

Fig. 9—Boundaries of pharyngomaxillary space

pterygoid muscle, the parotid gland and the parotideomasseteric fascia. Thus, there is a direct connection between the pharyngomaxillary space and the pterygomandibular space. The anterior limit is the pterygomandibular raphe, and the posterior boundary is the prevertebral fascia. The space is divided by the stylomandibular ligament into two compartments: an anterior and a posterior, the latter containing the carotid sheath and its contents.

There are two surgical approaches to the pharyngomaxillary space: (1) the classic T-incision of Mosher[4] and (2) a horizontal incision below the angle of the jaw.

The Mosher technic consists of a horizontal incision below the border of the mandible and a vertical incision anterior to the anterior border of the sternomastoid muscle. The surgical capsule of the submaxillary gland is identified and incised, and the gland is lifted upward. A finger is inserted under the gland in the direction of the angle of the jaw toward the styloid process, and entrance is made into the pharyngomaxillary space.

The approach from below the angle of the jaw is through an incision to the deep fascia, which is very dense in this

4. Mosher, H. P. Submaxillary fossa approach to deep pus in the neck. Tr. Am. Acad. Ophth. 34:19, 1929.

region. The fascia is penetrated with a hemostat and spread sufficiently to permit the insertion of a finger in the direction of the styloid process, and an entrance is made into the space.

■ *Conclusion*

Anatomy is a subject which demands periodic review and study. Accidental injury to important structures may be prevented if the relationship of one structure to another is thoroughly understood.

Acute infections and tumors of the mouth and neck may distort normal relations. To be thoroughly familiar with the normal increases one's ability to cope technically with the complications of the abnormal.

Pentobarbital sodium: appraisal of its use in oral surgery

■ *John T. Kelleher, D.M.D., Hartford, Conn., and James B. Griffin, D.D.S., Torrington, Conn.*

The purpose of this paper is to evaluate pentobarbital sodium (Nembutal Sodium), and to bring to the attention of the profession an office technic which will facilitate the work of the oral surgeon; one which will at the same time bring greater safety and comfort to the patient.

There are few reports in the literature on the use of this drug as an anesthetic adjunct. Fitch, Waters and Tatum[1] in 1921 were among the first to report on the intravenous use of pentobarbital sodium. Then little or nothing was published regarding the drug until 1931 when Rowbotham[2] reported on its use as an intravenous premedicant. Since that time, reports regarding the drug have been mainly on its use for obstetrical analgesia,[3] for treatment in preeclampsia and eclampsia,[4] or on its use as an adjunct in endotracheal intubation.[5] Also its use with thiopental sodium for prolonged general surgical procedures has been reported.

■ *Pharmacology and Chemistry*

Pentobarbital is ethyl (1-methyl butyl) barbituric acid. It belongs to the

1. Fitch, R. H.; Waters, R. M., and Tatum, A. L. Intravenous use of the barbituric acid hypnotics in surgery. Am. J. Surg. 9:110 July 1930.
2. Rowbotham, S. Premedication. Brit. M. J. 2:693 Oct. 17, 1931.
3. Abbott, W. F. Use of intravenous nembutal during labor. Canad. M.A.J. 27:620 Dec. 1932.
4. Ross, J. W. Nembutal in treatment of preeclampsia and eclampsia. Am. J. Obst. & Gynec. 31:120 Jan. 1936.
5. Carron, H.; Stoelting, V. K., and Cullen, S. C. Pentobarbital sodium-curare induction for endotracheal intubation. Anesthesiology 9:11 Jan. 1948.

group of short-acting barbiturates, has a relatively high safety ratio and is effective quickly in small dosages. When the sodium salt is administered intravenously, it produces almost instantly degrees of cerebral depression from sedation to complete anesthesia, depending on the size of the dose.

The first central nervous system effect is on the hypothalamus. Next the cortical centers are involved and depressed. The medullary centers are only slightly influenced when a normal therapeutic dose is given. Therefore this dose has minimal effect on respiration and circulation. Only when large doses are given is there medullary depression with the eventual sequelae of such a depression. In the gastrointestinal system the effect is not remarkable to any degree. This is also true of the blood; that is, there is little or no apparent change in the bleeding and coagulation time.

The vagal center is stimulated when small doses are administered and is depressed with larger doses. This phenomenon is also true with other reflex mechanisms such as the Hering-Breuer reflex, the laryngeal and the pharyngeal reflexes. After injection of atropine, which is used almost routinely prior to administration of pentobarbital sodium, a greater stimulus is needed to produce these reflexes.

There is no average dose of pentobarbital sodium. The importance of this point cannot be too strongly stressed. It must be administered slowly, at approximately the rate of 1 cc. per minute, and it must be remembered that the greatest depression occurs about ten minutes after the drug has been injected. A conversation should be carried on with the patient while the drug is being given. In this way the gap between consciousness and unconsciousness can be anticipated and the drug can be stopped at the proper time. It has been estimated that approximately 50 to 70 per cent of the lethal dose of this barbiturate is necessary to produce complete anesthesia, and since the degree and depth of intravenous anesthesia is difficult to control generally, this drug is not recommended when complete anesthesia is desired. To achieve a state of total anesthesia would require large and possibly toxic doses.

■ *Clinical Application*

The 5 per cent solution which comes in 50 cc., sterile, multiple-dose, rubber-stoppered bottles is recommended. This solution contains 10 per cent alcohol and 20 per cent propylene glycol as preservative and stabilizing agents. It contains 50 mg. of pentobarbital sodium per cubic centimeter of solution (or ¾ grain) but this can be diluted by adding distilled water to the desired amount.

The amount of solution used at one session in our office routine never exceeds 5 cc. of the 5 per cent solution. A 5 cc. syringe is filled with the solution and this syringe is connected to a needle already in the vein through which 1/150 grain of atropine sulfate had been given intravenously.

The pentobarbital sodium solution is then administered in slow fractional doses at about a rate of 1 cc. per minute. A conversation is carried on with the patient. After 2 to 3 cc. has been given, the patient's speech becomes very slurred and sluggish. Generally the administration of 2 to 3 cc. will be sufficient. In more

robust or highly excitable patients, however, it is necessary occasionally to administer a greater amount, that is, up to a maximum of 5 cc.

The intravenous injection is discontinued when the patient becomes drowsy. Then the nitrous oxide-oxygen anesthetic is administered in the routine manner. Generally anesthesia can be maintained with a much higher percentage of oxygen in the gaseous mixture, and there will be little or no excitement or muscular rigidity on the part of the patient during induction.

After the operative period, the patient regains consciousness quickly and there is rarely any nausea or vomiting. The patient is put in a recovery room to rest and usually he is ready to leave the office in approximately half an hour.

With patients for whom a general anesthetic is contraindicated or with highly apprehensive individuals who desire a local anesthetic, this solution is effective when given in conjunction with a local anesthetic.

The anesthetic usually is injected first and while waiting for it to become effective the intravenous injection is started. The entire amount desired may be given before starting the operation, or it may be given fractionally as the procedure progresses. In either case, it should be borne in mind that an aggregate dose of 5 cc. must not be exceeded.

■ *Complications*

It cannot be too strongly stressed that dosage varies greatly with each individual and therefore the operator must observe each patient and decide how much of the solution to administer. Extremely apprehensive individuals necessarily require more premedication than do the calmer patients. The nervous patient is more apt to be given an overdose. This results in extreme depression which requires an extremely long recovery time. This is further reason why a slow injection technic is essential. A slow injection method affords the operator a better opportunity to observe the patient and to note the effects of the drug.

Because of the depressant effect of the drug, blood pressure may be lowered temporarily. Preoperative and postoperative blood pressures should be taken. If too great a change is noted, necessary vasoconstrictors should be used.

Laryngospasm is not to be feared with this solution. In more than 2,000 administrations, we have yet to encounter this difficulty as a result of its use. Of course normal precautions are taken, such as the proper placement of throat packs, maintenance of sufficient aspiration during operation and the intravenous use of atropine.

■ *Summary*

The use of intravenous pentobarbital sodium as an anesthetic supplement is recommended. It is an excellent simplified method for use in oral surgical procedures and one which lessens the difficulties for both the patient and the operator.

The drug is satisfactory for the purpose when used as described herein. It should not be used by those who have not had some previous training in intravenous anesthesia or by those unwilling to take time to use it properly.—99 *Pratt Street.*

Localized osteitis fibrosa and cementoma

■ *Andrew F. Catania, M.D., D.D.S., Brooklyn*

"The literature on bone pathology is replete with controversial statements and classifications . . . but laxity in the use of technical terms adds to the confusion."[1] Disagreement exists even among experienced pathologists as to the microscopic differentiation of localized osteitis fibrosis from generalized osteitis fibrosa cystica (Recklinghausen's disease, hyperparathyroidism), osteitis deformans (Paget's disease), fibrous dysplasia, central giant cell tumor, traumatic hemorrhagic bone cyst,[1] and also the early osteolytic (radiolucent) stage of cementoma.[2,3,4] Attempts to find an adequate label for the pathology of localized osteitis fibrosa have given rise to a long list of perplexing synonyms: osteofibroma, fibrous osteoma, ossifying fibroma, localized osteodystrophia and hypertrophic localized osteitis.[5]

Localized osteitis fibrosa is a disease of unknown etiology. It is characterized by resorption of bone trabeculae which is followed by fibrosis of the bone marrow and spongiosa.[2] It is a slow-growing painless tumor which transforms the architecture of the bone, usually producing a small swelling.[6]

Frequently there is a history of trauma with evidence of intraosseous hemorrhage. The theory is that bone destruction comes after trauma but soon is arrested and the ultimate reparative process results in so-called "osteitis fibrosa," a new osseous structure composed of numerous irregular bone trabeculae with fibrous tissue replacing the bone marrow. The cortex may be thinned out but it is rarely perforated. In some instances, where the destruction proceeds to cyst formation, the cavity is lined with fibrous connective tissue.[2]

The disease differs from generalized osteitis fibrosa cystica (Recklinghausen's disease, hyperparathyroidism). There is no withdrawal of calcium from the bones, no hypercalcemia, no undue excretion of calcium in the urine, no lowering of the serum phosphorus and no elevation of phosphatase. The lesion is not of dental origin.

Cementoma is a lesion that has some of the characteristics of localized osteitis fibrosa, thus the term "periapical osteofibrosis."[2] It presents no clinical symptoms since the teeth remain vital, although roentgenographically the lesion has the appearance of granulomas resulting from pulpless teeth. The actual etiology is un-

Assistant professor, department of oral surgery, New York University College of Dentistry, New York. Associate, dental departments, Greenpoint Hospital and Maimonides Hospital.

1. Sicher, H. Some principles of bone pathology. J. Oral Surg. 7:104 April 1949.

2. McCall, O. P., and Wald, S. Clinical dental roentgenology. Philadelphia, W. B. Saunders Co., 1942.

3. Phemister, D. B., and Grimson, K. S. Fibrous osteoma of jaws. Ann. Surg. 105:564 April 1937.

4. Bernier, J. L., and Thompson, H. C. Histogenesis of the cementoma. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 32:543 Sept. 1946.

5. Thoma, K. Oral pathology, ed. 2. St. Louis, C. V. Mosby Co., 1944.

6. Thoma, K. Oral surgery. St. Louis, C. V. Mosby Co., 1948.

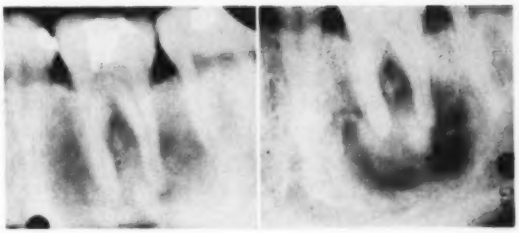

Fig. 1—Left: Intraoral roentgenogram of the mandibular right first molar taken in May 1943. Note radiolucent area which involves both roots. The radiolucent area completely envelops an irregular radiopaque mass between the apexes of both roots. Right: Intraoral roentgenogram of mandibular right first molar taken in July 1949

known; however, trauma succeeded by intraosseous hemorrhage is the most generally accepted hypothesis.[7] Thoma[5] lists three stages of development: osteolytic, cementoblastic and finally the mature inactive state. In the first stage there is abundant fibrous tissue which presents an appearance similar to that of localized osteitis fibrosa. Cementoma produces no abnormal hematological findings.

■ *Report of Case*

A 28 year old white woman came for examination on July 22, 1949. A painless swelling had been present for six years in the first molar region on the right side of the mandible. She had first realized the presence of the swelling in May 1943. At that time her family dentist took an intraoral roentgenogram (Fig. 1, left) and explained that "her jaw was stronger on the right side than on the left." No other roentgenograms were taken until July 15, 1949 when she visited another dentist. He referred her to an oral surgeon for consultation.

PAST HISTORY — The patient had been treated several years for moderate hypertension and apparently had responded favorably. The patient could not recall any episode of trauma to the involved region.

EXAMINATION—There was definite facial asymmetry because of a slight swelling in the lower part of the right cheek. Palpation of this area demonstrated a discrete, immovable, bony-hard, painless, smooth bulge of the mandible. No cervical lymphadenopathy was present. The general intraoral hygiene was good. There was a visible diffuse swelling of the buccal aspect of the mandibular molar region on the right side. No signs of inflammation were evident. The overlying soft tissue was normal in color and texture. The bone was not compressible. The lingual bony plate and the floor of the mouth were normal. The mandibular first and second molars and bicuspids on the right side were immobile and responded normally to pulp testing.

An intraoral roentgenogram (Fig. 1, right) revealed a large, circular, poorly-outlined, radiolucent area involving both roots of the first molar. The radiolucent area completely enveloped a smaller, round, irregular, radiopaque mass. Roent-

7. Cahn, L. R. Pathology of oral cavity. Baltimore, Williams & Wilkins Co., 1941.

genograms of the entire mouth failed to disclose any similar lesions.

TENTATIVE DIAGNOSIS—The radiopaque mass was considered to be a large region of sclerotic bone, hypercementosis or a cementoma. The radiolucent area was diagnosed as a possible central giant cell tumor.

TREATMENT—On August 26, 1949, under mandibular nerve block and infiltration anesthesia, a mucoperiosteal flap was reflected extending from the first bicuspid to the edentulous third molar region. The bulging buccal plate was intact and so hard it could not be compressed. Extraction of the first molar exposed a bony cavity which contained no fluid, debris or sequestra. The cavity was divided by a thick, roughened, white, round, bony mass extending across the socket from the bulging buccal plate to the lingual plate. The white mass was flintlike in consistency and small chips could be chiseled away only with extreme effort. The cavity was partially lined with a thin, gray, friable membrane. The second bicuspid was extracted also because the entire length of the distal aspect of its root was devoid of investing bone. The mandibular canal and its contents were not involved. All tissue recovered was sent for pathological examination.

PATHOLOGIST'S REPORT—The macroscopic examination showed innumerable bony fragments which aggregated 15 mm. by 10 mm. by 7 mm. The color varied from buff to pinkish gray. The buff-colored fragments suggested parts of the outer (mandibular) bony plate. A minimal amount of soft tissue (5 mm. by 3 mm. by 1 mm.) was reddish gray in color.

Microscopic examination of a section through the bony fragments showed a varied appearance histologically. Some fragments showed attenuated bony trabeculae. The intertrabecular spaces were filled with loose connective tissue. Other fragments showed rather irregular bony trabeculae where the intertrabecular spaces were filled with dense connective tissue. In many fragments spindle-shaped cells predominated. Their fibers blended into osteoid tissue in which were embedded elongated, round, often irregular, islands of bone with conspicous osteocytes surrounded by osteoblasts. Osteoclastic giant cells were seen infrequently. One fragment which was covered by thin strands of connective tissue in certain areas was made up of dense bone containing channels with blood vessels. It was lined by osteoid tissue and osteoblasts. Numerous lines of bone apposition were conspicuous; however, it did not present a typical mosaic appearance.

Examination of a section of the soft tissue showed it to be made up of loose connective tissue with diffuse hemorrhage and numerous capillaries. In some regions the capillaries reached the surface and in other regions edematous stratified squamous epithelium was seen on the surface. Numerous polymorphonuclear leukocytes were found within the epithelium.

DIAGNOSIS—The pathologist's diagnosis was localized osteitis fibrosa (Fig. 2, left). One small fragment suggested cementoma (Fig. 2, right). He strongly recommended that a blood chemistry investigation be made which would include

serum calcium, serum phosphorus and alkaline phosphatase determinations.

POSTOPERATIVE COURSE — Healing was uneventful. Several laboratory tests, including those recommended by the pathologist, were performed in order to discover any possibility of systemic etiology. All were essentially normal.

An intraoral roentgenogram (Fig. 3) taken on March 16, 1951 revealed a diminution of radiolucency at the site of operation which indicated normal healing of bone. The bulging buccal plate remained unchanged.

■ *Comment*

In recent years there have been differences of opinion regarding the nomenclature associated with various bone changes. Terms have been so loosely applied that they now have lost their particular meaning.[8] The occurrence of two pathologic osseous lesions, localized osteitis fibrosa and cementoma, in the case described prompts a discussion and evaluation of the existing status of closely allied bone lesions. Such coexistence is not frequent.

Cahn[7] described two cases of cementoma associated with localized osteitis fibrosa. Bernier and Thompson[4] stated that bone manifestations referred to as ossifying fibroma, fibrous osteoma or fibrous dysplasia may be essentially similar to cementomas in their earlier stages.

8. Mammel, C. K. Histological comparisons of localized fibrous dysplasia of bone and ossifying fibroma. J. Oral Surg. 6:27 Jan. 1948.

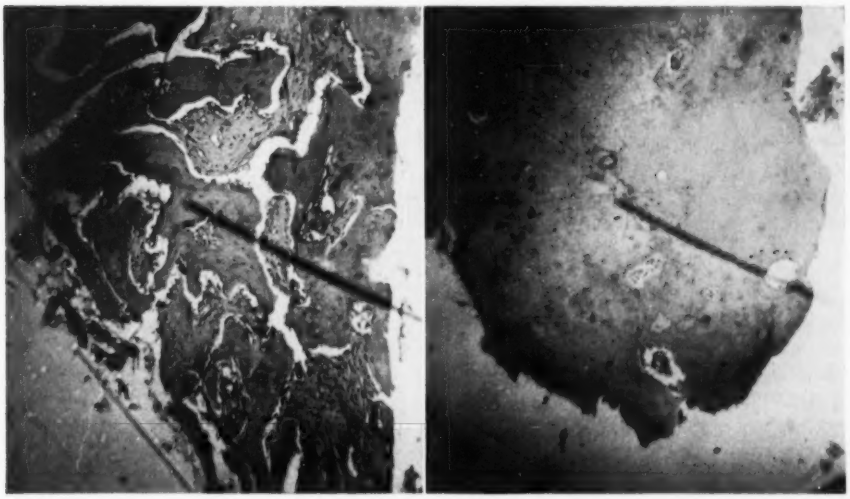

Fig. 2—Left: Photomicrograph of specimen of surrounding bone diagnosed as localized osteitis fibrosa. Note strands of fibrous tissue between which new bone trabeculae have been formed. Right: Photomicrograph of specimen of white flintlike column of bone, diagnosed as cementoma

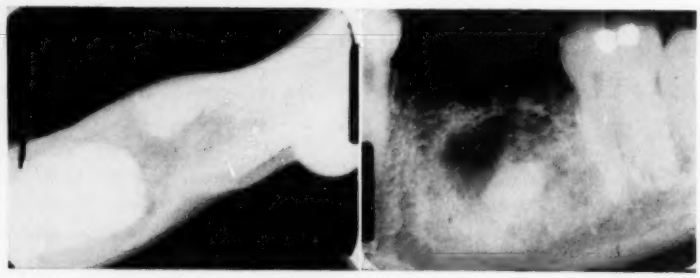

Fig. 3—Postoperative intraoral roentgenograms taken March 16, 1951 showed diminution of radiolucency

They emphasize the important fact that the normal function of the periodontal membrane produces bone as well as cementum. Can this be the nidus from which both lesions arise?

All the synonyms for localized osteitis fibrosa are the result of the varied appearance and changeable proportion of soft and hard tissues.[5] Thoma favors both Furedi's[9] term "fibro-osteoma" and Phemister's[3] term "fibrous osteoma" because this terminology more accurately describes the histopathological conditions. Thoma[5] classifies the conditions into three types: central ossifying fibroma, fibro-osteoma and fibro-osteoid-osteoma.

CENTRAL OSSIFYING FIBROMA—Phemister and Grimson[3] suggested this term for tumors in which fibrous tissue is overabundant and the bone trabeculae are only beginning to form. Ossifying fibroma may be the primary stage of fibro-osteoma. The name "ossifying fibroma" should be reserved for fibromas, peripheral or central, in which a few bony trabeculae are formed—in other words, a tumor formed of connective tissue in which bone formation is a secondary phenomenon.[6]

FIBRO-OSTEOMA—This term applies to the stage of development in which resorption and new bone formation continue, with the latter in excess. The bone becomes enlarged and facial deformity results.

FIBRO-OSTEOID-OSTEOMA — This applies to bone formation which remains poorly calcified.

According to some authors,[3] exostosis, localized osteitis fibrosa, osteofibroma, ossifying fibroma, osteoma and fibrous osteoma have the following characteristics in common:

1. No bone disease in the rest of the skeleton.
2. No cases reported to have undergone sarcomatous changes.
3. No abnormalities of blood calcium and phosphorus.
4. Possible recurrence, although these lesions are benign.

Single local lesions of fibrous dysplasia appear frequently and since the formation of fibrous connective tissue is

9. Furedi, A. Study of so-called osteofibromas of the maxilla. D. Cosmos 77:999 Oct. 1935.

often the normal response of tissue to stimuli, it is reasonable to assert that they are varying stages in the reparative process. If the process were to continue, the ultimate would resemble ossifying fibromas. For this reason, Mammel[8] has stated the belief that the differences between fibrous dysplasia and ossifying fibroma are really variations of a single process. He feels the terms "ossifying fibroma," "fibro-osteoma" and "fibrous dysplasia" are used to describe various phases of a single pathologic process.

Schlumberger[10] observed that with the increasing frequency of the appearance of fibrous dysplasia in single bones, and

> . . . since histologic criteria do not exist by which fibrous dysplasia of the maxilla or mandible can be distinguished from "so-called" ossifying fibroma, and because their clinical behavior is identical, it is concluded that the ossifying fibroma is a variant of fibrous dysplasia.[11]

To make explicit suppositions regarding histologic differences between fibrous dysplasia and ossifying fibroma is not easy. The resemblance is so close that eminent investigators such as Lichtenstein,[12,13] Phemister and Grimson[3] and Mallory[14] find it almost impossible to distinguish between them.[11] This was dramatically demonstrated when Schlumberger's[10] cases of fibrous dysplasia were submitted to several pathologists; only 28 per cent favored the diagnosis of fibrous dysplasia while others diagnosed the specimen as osteitis fibrosa, giant cell tumor, ossifying fibroma, osteodystrophia and traumatic bone cyst.[8] In his original article on fibrous dysplasia, Lichtenstein[13] regarded a so-called central osteoma histologically identical with fibrous dysplasia. Several of the cases which he considered indistinguishable from fibrous dysplasia had been reported by Phemister and Grimson[3] as fibrous osteomas. In 1942, Mallory[14] accepted the probability that they are one and the same.

■ *Summary*

A case report of localized osteitis fibrosa cystica and cementoma is presented. The only symptom was swelling of the mandible for a period of six years. A thorough laboratory analysis eliminated the possibility of the existence of generalized osteitis fibrosa cystica (Recklinghausen's disease). The roentgenographic and histopathologic similarities and variations of localized osteitis fibrosa and early cementosa are discussed.

Since these intraosseous lesions are so similar in nature and character and since they are examined at various stages of development, a differential diagnosis is difficult to make.—*1 Hanson Place.*

10. Schlumberger, H. G. Fibrous dysplasia of single bones (monostotic fibrous dysplasia). Mil. Surgeon 99:504 Nov. 1946.

11. Schlumberger, H. G. Fibrous dysplasia (ossifying fibroma) of the maxilla and mandible. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 32:579 Sept. 1946.

12. Lichtenstein, L., and Jaffe, K. Fibrous dysplasia of bone. Arch. Path. 33:777 June 1942.

13. Lichtenstein, L. Polyostotic fibrous dysplasia. Arch. Surg. 36:874 May 1938.

14. Mallory, T. B. Medical progress; pathology, diseases of bone. New England J. Med. 227:955 Dec. 17, 1942.

Exodontic problems

■ *James R. Hayward, D.D.S., M.S., Ann Arbor, Mich.*

To evaluate any extraction as simple or complex, a score of elements must be taken in account. The complexity might be expressed as a ratio between the clinical problem and the knowledge, judgment and ability of the surgeon. A difficult clinical problem may entail technical blunders, invasion of adjacent vulnerable anatomy, stormy recovery periods, infections, or hazards to the safety of the patient. They are avoided, not through an exceptional instrument or technic, but through a procedure based on sound principles. Most oral surgeons will admit that complications in exodontics arise from omissions and errors. In preoperative management they are omissions or errors in diagnosis, in patient appraisal, and in treatment planning. In operating technic they arise from an expedient disregard for surgical principles, from uncontrolled force, and from careless handling of tissue. In the postoperative period they arise from neglect in supervision. Prevention of these major sources of trouble may be achieved by the following: first, a sound diagnosis and appraisal of the patient; second, an effective treatment plan based on care and surgical principles, and third, a diligent postoperative management.

Good preoperative management will avoid the most serious pitfalls. In appraising the patient a brief history must be taken so as to detect allergies, bleeding tendencies, and significant underlying systemic disease. It takes only a few seconds to gather this information. Detailed and complete medical histories are not necessary but certain essential facts must be known in order to make a diagnosis. To subject a patient to an anesthetic and extraction without knowledge of his physiologic reserve and surgical history is to assume an unjustified risk. A sound diagnosis requires a complete study of the facts learned from the history, the clinical and roentgenographic examination and the laboratory findings. Any one of these elements may be misleading in itself. A single symptom, an isolated clinical impression, or a single roentgenogram can lead to a false diagnosis. Symptoms of pain may be referred, teeth may be loose from neoplastic bone destruction rather than from periodontal disease, and shadows projected on a roentgenogram may give false illusions of anatomy. The final differential diagnosis must stem from interchange of facts based on a knowledge of the anatomy, physiology and pathology.

Treatment plans for extractions follow the diagnostic requirements of the clinical problem and appraisal of the patient. The first important decision is selecting the anesthetic. In answers to a questionnaire circulated to 400 members of the American Society of Oral Surgeons, nearly 25 per cent of the men listed anesthesia as their most significant prob-

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lem in exodontics. Constant advances in anesthetic agents and technics eventually may solve the special problems in the oral surgery field, which are chiefly to provide as much comfort for the public as possible and at the same time minimize anesthetic hazards. Oral surgeons hope each new agent will fulfill their requirements. At present, there is considerable study of trichloroethylene for use in oral surgery. Although newer and better agents and technics may be anticipated, a few basic rules of anesthesia cannot be ignored.

No anesthetic can be administered safely and successfully to all patients; the agent must be adapted to the needs of the individual and his problem. The contribution to the safety and success of all anesthetic agents by premedication should be utilized fully. Many of the drugs now available will make patients receptive to anesthesia and protect them from side reaction hazards of anesthesia. Mental preparation of the patient often does as much as drugs. Many patients have an entrenched fear of extractions and they need extra reassurance. A state of extreme anxiety is physiologically undesirable to the induction of all anesthetics. Proper handling of the patient will aid both the procedure and the patient's future attitude toward the experience. More attention needs to be focused on rapid and efficient means to reduce anxiety and neuroses associated with oral surgical procedures.

In employing anesthetic agents, the synergistic action of some combinations may cause less physical disturbance and consequently enhance the patient's safety. Combinations of general and regional local anesthetics are gaining popularity in all phases of surgery. This type of balanced anesthesia has been used commonly in exodontics for many years. Since extractions are nearly always elective, the anesthetic agent of choice must provide the maximum margin of safety. A poor choice of agent or a faulty technic in its administration cannot be justified.

Regardless of the type of agents administered in an office, it is imperative to have equipment for emergency resuscitation at hand. Quick evaluation of cardiac and respiratory emergencies may save a life. Forced oxygen and equipment for the maintenance of an airway are mandatory. Although a lifetime of practice may never require an emergency tracheotomy or direct massage for cardiac arrest, oral surgeons are obligated to be able to perform such measures without delay should a crisis arise.

Finally, profound and effective anesthesia is prerequisite to all successful extractions. Incomplete or uncontrolled anesthesia puts the operator under such pressure that he cannot perform careful surgery.

■ *Basic Surgical Principles*

A paradox is inherent in surgical technic in extractions. An aseptic procedure must be attempted in a field harboring abundant bacteria. The oral surgeon's efforts are directed wisely to prevention of cross infection and exogenous infection by a rigid sterilization routine. Oral sepsis before elective surgery is reduced and also the introduction of bacteria into deep tissues is avoided. These are logical safeguards, since infection is the single, most important local factor influencing the healing of wounds. The establishment of an infection depends on

many conditions, among them the number of organisms, their virulence, invasiveness, drug resistance, the presence of dead or severely injured tissue, hematomas, foreign bodies, and all of the local and systemic defense mechanisms of the body. In the surface tissues of the mouth there is amazing resistance to oral bacteria, but when some of the same organisms are carried into deep structures, infections may develop. Through experimental evidence it has been shown that the mucin of salivary secretion promotes the establishment of infection. Hence the clinical practice of injecting into a dry field and keeping saliva out of extraction sockets during clot formation have a rational basis. Although complete asepsis is difficult and at present impractical in extractions, it must be striven for in order to avoid the constant threat of infection.

A second surgical principle in exodontics is hemostasis. By opening vascular beds of bone and soft tissues, the extraction hemorrhage may be profuse and complex. True bleeding tendencies are rare, and most difficult extraction hemorrhage stems from hypertension, trauma, and secondarily from infection. The true bleeding tendency must be identified by a laboratory differential diagnosis. Rational therapy then may correct or attenuate the defect so that the extractions are tolerated. Extreme care with transfusions and utilization of hospital facilities are, of course, the rule.

A clear operating field is obtained by suction, sponges, and hemostasis obtained through the use of vasoconstrictors, topical thrombin, and other hemostatics. While using vasoconstrictors for local hemostasis it is necessary to respect their systemic effects and limit their quantity. Spurting hemorrhage from bone indicates mechanical burnishing of cancellous trabeculae, or in refractory canal and cortical perforations, bone wax or other plugging material may be required. Hemorrhage from the soft tissues responds to pressure and tying rarely is required in the regions of the extraction. Controlled hemostasis is essential to clear vision and without clear vision there can be no operating efficiency.

Other essentials for clear vision in the field are light and access. Blind manipulation invites complications. A good headlight will always provide direct illumination of a small field where and when it is needed. In any complex or refractory extraction, vision is needed and access is provided by an adequate mucoperiosteal flap. Well designed and carefully handled flaps add no trauma to the procedure. To insure an adequate blood supply for the flap it should be made with a broad base, and the margins should be kept well outside the zone of bone removal. This procedure will allow for good support by a sound plate of bone and prevent the flap from sinking into the cavity. Access provided by flap reflection, good retraction, and proper position of the patient will allow the surgeon to reach the remote recesses.

If there is any single principle in tooth removal it is controlled force. No resistance of the tooth during extraction calls for or justifies excessive force. Fractured roots, broken tuberosities and antral floors, and many temporomandibular joint disturbances are a direct result of uncontrolled force. The delivery of a tooth is no reward when it brings these complications with it. Tooth sectioning and relief

of impinging bone are the cardinal principles of controlled force. Traction holes in roots will aid in safe elevation.

When the "simple extraction" is not so "simple," a minor local condition is often the cause. Crowns may be malposed or weakened by caries, erosion, abrasion, or extensive restorations in the location where forceps are applied. Brittle, nonvital tooth structure prevents effective instrumentation. Root anomalies in size and form, hypercementosis, and supernumerary roots all complicate usual procedure. The periodontal membrane attachment may be abnormal and partially obliterated by cementicles. There may be complete ankylosis or partial ankylosis with irregular resorption of the root and replacement by bone. Surrounding alveolar process may be massive or exceedingly dense because of condensing osteitis and hypercalcemic bone. If there is good vision and controlled force is used, such local conditions have minor significance. The real hazard lies in the fact that they are easily overlooked or underestimated.

■ *Management of Impacted Teeth*

Management of impacted teeth is dictated by their exact position, by their relation to surrounding bone and adjacent teeth, and by their relation to vulnerable zones of anatomy. Knowledge of the various classifications of third molar impactions will expedite appraisal in specific instances and indicate a time-saving approach. One of the major advances in impaction removal has been the conservation of alveolar process and reduction of trauma through tooth sectioning. The selection of a chisel, an automatic chisel, or bone drills for this work is up to the individual, but the instrument must be sharp and correctly applied. Tooth sectioning has countless modifications. Deep horizontal impactions require that the crown be removed for advancement of the roots. In vertical or distoangular impactions it is helpful to section the tooth so that the fragments will be accessible. The crown should not be cut off at a low level as this might leave the roots inaccessible, deep beneath the second molar. When sectioning is done with drills, it is advisable first to loosen the tooth, detaching some of the periodontal attachment for easier delivery of the sectioned roots. When sectioning is done with a chisel, however, any preliminary elevation and loosening creates a cushion which prevents effective splitting with the chisel. Impactions with undeveloped roots, the ball-in-socket variety, respond better to sectioning with drills rather than chisels because of the same cushioning effect of the follicle. The use of bite-blocks and manual support for the mandible will reduce trauma to the temporomandibular joint. Impactions involve the possibility of invasion into the inferior alveolar canal, the maxillary sinus, the infratemporal fossa, and the submaxillary fossa. As the surgeon approaches these zones to recover impactions and root fragments, the instrumentation becomes increasingly delicate and complete control of the direction of the instrument and degree of force is necessary. It is the careful handling of tissue that insures promotion of healing and prevention of complications.

■ *Preparation for Dentures*

Preparation of a mouth for dentures requires satisfactory contouring of the ex-

traction site. Undercuts, sharp irregularities, and interferences with proper interarch space and interarch symmetry are corrected by careful alveolectomy. Although radical alveolectomy yields a fine immediate result it may sacrifice the future success of the prosthetic foundation. Alveolar extensions of the maxillary sinus definitely limit alveolectomy. Preservation of ridge height and creation of a rather flat ridge crest are desirable, with minimal trimming of buccal and labial plates. Sharp projections on the lingual ridge crest and mylohyoid area frequently are neglected and cause postoperative difficulty. There is a logical middle ground in the degree of process trimming, and a tendency toward conservatism is healthy. Contouring should be limited to the requirements of the denture foundation.

■ *Soft Tissue Surgery*

Soft tissue surgery in exodontics calls for plastic surgery technic to remove excesses of gingival tissue, frena, and to adjust muscle attachments. Rapid healing and postoperative comfort are proportionate to care in closure of operative sites. In complicated extractions, chips of bone and tooth often are left where they cause trouble. All of this nonviable tissue must be eliminated by thorough débridement. A postoperative roentgenogram of the extraction site will provide final insurance when the extraction has been difficult. It is also advisable to test the walls of the socket with a fine curet for possible fractures of plate that might sequestrate. Granulation tissue is a phase of healing, but it should be removed from chronic periapical lesions. Besides being potential reservoirs of infection, these granulomas contain epithelial elements which may develop residual cysts. For the same reason the reduced enamel epithelium around the crowns of unerupted teeth should be enucleated. If it is retained in the alveolar process, this epithelium can develop a cyst or even develop an ameloblastic neoplasm of bone.

■ *Postoperative Treatment*

To complete the extraction, the wounds sometimes are dusted with antibiotics or cones of topical antibiotics are inserted, in spite of some justified criticism. With greater choice of antibiotic agents it is now possible to select a specific one which is limited to local use, such as bacitracin. With this possible discrimination in selection of agent and with the availability of antihistamines, the problems of sensitization and reactions are minimized. When the antibiotic is used in pure form and in small amounts and is incorporated with the blood clot, it probably will not interfere with healing and may be beneficial.

In larger bone defects the primary organization of a blood clot is impossible, and central liquefaction and dead space are to be expected. A central scaffold of absorbable material is desirable, and all of the foam products have been tried. Use of oxidized cellulose is limited since it is said to liberate an acid which delays bone healing. The poor handling qualities and expense of fibrin foam have discouraged its use. When absorbable gelatin sponge first was tried it gave rise to a few severe infections. Presumably the organisms of oral fluids found an ideal culture medium in the gelatin. Various antibiotics (recently bacitracin in saline solution of 500

units per cubic centimeter) in absorbable gelatin sponge have shown promise.

Postoperative treatment brings up the controversial subject of dressings. Some men prefer to dress every extraction site and others rarely use dressings. Three things are accomplished by dressings. They eliminate dead space, they promote drainage, and they carry obtundent drugs to the sites of healing. The decision to use a dressing must take into account the size of the defect, the local condition of the tissues, and the healing potential of the patient. It is well to remember, however, that while dressings keep the patient comfortable, they do not contribute to repair and should not be continued after the period necessary to promote drainage or control pain.

Just as preoperative mental preparation of a patient can be helpful, so an understanding of the postoperative course together with definite instructions will prevent complications. Verbal and printed instructions will prevent many patients from getting into trouble. Without precautions they will wash blood clots out of sockets, use local irritants, and get hysterical over trivial symptoms. If the patients know what to expect, and follow instructions, much unnecessary anxiety can be avoided. Saliva is kept out of the clotting socket with gauze sponges. After complete hemostasis and inspection of the extraction site, a firm gauze compress is inserted and the patient is dismissed with instructions to maintain pressure on the gauze for 20 minutes before discarding it. This tends to prevent bleeding under flaps and to minimize initial traumatic edema. After extensive surgery intermittent cold applications are advised for the first 8 to 10 hours because local circulation and local tissue metabolism are reduced and to some extent the exudative phase of inflammation is minimized. With adequate sedation and suggestions for general supportive care, the operator encourages an uneventful recovery. Current advances in synthetic analgesics have given the oral surgeon a wide selection of drugs. These agents have the advantage of profound analgesia without the narcosis and amnesia of morphine sedation.

In order to abort complications, the patient should be seen 48 hours postoperatively. Both traumatic edema and pain should be subsiding at that time. If there is steady increase in pain and swelling, an infection should be suspected and corrective measures should be quickly instituted.

If antibiotic agents are used early, and in massive doses, an infection can be aborted and deep tissue abscesses can be prevented. Once the infection has become established for several days and pus has formed, antibiotics in themselves are not curative and drainage is imperative. By culturing exudates for identification of the organism and its antibiotic sensitivity by the disk method, the most effective therapy can be determined. Patients on antibiotic therapy must be seen regularly in order to watch the responses and reactions. If there is no favorable clinical response after 48 hours, the agent should be changed. It is unwise to prolong the use of an antibiotic for an extended period after recovery from the infection symptoms. Disturbances in oral and gastrointestinal flora bring about local and systemic side effects that may be serious. Knowledge regarding antibiotics and their effect still is far from complete. No week passes

without some addition or change in the field. For example, dangerous reactions to chloramphenicol have been reported recently and observations have been recorded on the toxic effects of streptomycin, on incompatibility between penicillin and chloramphenicol, on the synergistic action of penicillin and streptomycin and on the resistance to penicillin by an increasing number of bacterial strains. It is the duty of the oral surgeon to keep up to date on the facts and to be discriminating in the application of these drugs.

■ *Additional Complications in Exodontics*

Additional complications in exodontics are involvement of the maxillary sinus and management of dry socket. First emphasis, naturally, is on prevention of these complications. An operator has adequate warning of the proximity of the maxillary sinus through roentgenographic examination and he should inform the the patient of this hazard before the extraction is begun, reassuring him that all possible precautions will be taken. Then, through use of controlled force, tooth sectioning, and the skillful recovery of root apexes, invasion of the antrum usually can be avoided. In recovering a root accidentally lodged in the sinus, the concern of the surgeon is to prevent an oroantral fistula and to cause the least possible disturbance to the normal sinus mucosa. Immediate preoperative roentgenograms usually will locate the root, and the surgical approach is through the canine fossa above the apexes of the bicuspid teeth. The root fragment is recovered by skillful instrumentation or with an aspirator tip, using gende irrigation with a normal saline solution. After the window of the canine fossa is closed, the buccal plate may be reduced and further measures taken to promote soft tissue closure and protection of the socket. Antibiotics are administered locally or parenterally, and the patient is cautioned to avoid intranasal pressure. This problem is not complicated, of course, if the sinus is reasonably healthy. More effort will be required if the root is lodged between the mocosa and bony sinus walls or if septal partitions are found within the sinus. When a diseased sinus is encountered while recovering a root, and the mucosa is thickened and the chamber is full of polypoid tissue and pus, recovery of the root is difficult and it may be impossible to prevent an oroantral fistula through the socket. Normally, such a condition would call for the cooperation of a rhinologist. However, treatment cannot be delayed in this situation because of specialty boundaries. Once the exposure has been made and the diseased condition encountered, the polypoid and thickened mucosa is stripped away, the root recovered, and nasal drainage is encouraged by making a window into the nose below the inferior concha. The sinus is irrigated with penicillin and packed with sterile gauze impregnated with petroleum jelly or Peru balsam in a manner that permits removal through the nasal opening. The canine fossa opening and socket areas are closed in the usual manner and generous antibiotic and supportive care instituted. This procedure is not elective Caldwell-Luc surgery but rational treatment in an unusual situation.

Every oral surgeon who addresses a group of general practitioners is asked how he treats a dry socket. The term "dry

socket" is a poor description of the actual disturbance. The delay in healing results from failure of organization and retention of the clot. Pain results from exposure of the nerve endings in alveolar bone. Osteitis of the lamina dura terminates with sequestration and liquefaction, followed by coverage with granulation tissue in about ten days. According to one theory, the disturbance arises from a loss or damage to the periodontal membrane tissues of the socket. Connective tissue and vascular elements of the periodontal membrane serve as centers for organization of the clot within the socket. When the membrane is completely avulsed with the extracted root or destroyed by trauma through mechanical or chemical injury, the clot will fail to organize and will be lost. This theory is under experimental investigation. Others factors of etiology of contributory but secondary importance may be a so-called "predisposition" to dry socket, local blood supply to the extraction site, and infection. Once the process has begun, the treatment should be palliative. The patient is kept comfortable until processes of repair alleviate the situation.

A great variety of obtundent drugs and agents are used in the treatment of dry sockets. In a recent questionnaire sent to a group of oral surgeons, no less than 75 different drug preparations were reported. Fifty of these preparations contained eugenol and other essential oils, three in combination with zinc oxide as a cement; seven contained benzocaine, tetracaine hydrochloride, lidocaine hydrochloride and other local anesthetics; eight contained strong chemical caustics; three contained antibiotics for local administration, and eight contained only bland obtundent protective agents. Three men advised curettage and secondary surgical treatment.

The rational treatment is conservative and should promote comfort while encouraging repair. Strong caustics and curettage are ill-advised. Only obvious sequestra need be removed. To make the obtundent dressing effective, the socket should be gently irrigated, cleansed of debris, and dried before the dressing is inserted. Frequency of dressings, choice of obtundent drug, supportive sedation, and antibiotic care are indicated by the patient's symptoms and trends in the postoperative course. Although most of these conditions run a routine and favorable course of 10 to 14 days, careful supervision is needed to preclude extending infections and osteomyelitis.

■ *Summary*

The difficult exodontic problems are handled successfully by accuracy in diagnosis, by efficiency of treatment plan, by technic based on surgical principles, and by diligence in postoperative supervision. No single instrument or expedient technic can be depended on to simplify the problems of exodontics.

■ Man's Stability

Our stability is but balance, and our wisdom lies in masterful administration of the unforeseen.—*Robert Bridges.*

Cardiac arrest

■ *Dan E. Brannin, D.D.S., M.S.D., Tulsa, Okla.*

Cardiac arrest is the most serious emergency which may confront a surgeon. Unfortunately, it is poorly understood by most oral surgeons and is inadequately treated in many instances.[1]

The necessity for immediate diagnosis and instant treatment cannot be overemphasized. Weinberger, Gibbon, and Gibbon[2] demonstrated in animals that permanent alterations in behavior and psychic function occurred after three minutes and twenty-five seconds or more of circulatory arrest. When resuscitation saves life, but not early enough to prevent brain damage, the following effects may result: blindness, deafness, parkinsonism, athetoid and choreiform movements, speech defects and emotional instability.[3] The pathologic physiology is for the most part the result of anoxia. The cells of the body vary in tolerance to anoxia. Unfortunately the neurons of the brain are the earliest damaged and the last to recover.[4] Brown-Sequard in 1858 demonstrated that the cerebrum, medulla oblongata, spinal cord, and peripheral nerves were affected in that order.[2] Cardiac tissue is more resistant and for that reason may resume function even though cerebral damage in a like period may have been irreversible. Thus, it is obvious that the surgeon and anesthesiologist must themselves deal with the emergency in the operating room. There is no time to seek help elsewhere.

■ *Etiology*

Cardiac arrest is the result of several factors. Bonica,[5] however, echoes the now prevalent opinion that hypoxia or anoxia is the common denominator in all cases of cardiac arrest. Thus, the administration of any anesthetic agent at the expense of adequate oxygenation of the patient is to be deprecated. Any airway obstruction must be cleared immediately. In fact, any interference with adequate oxygenation of the patient must be effectively dealt with at once.

The causes of cardiac arrest may be divided into three broad groups.[6]

VENTRICULAR FIBRILLATION—The injection of epinephrine in a patient under cyclopropane, chloroform, or ethyl chloride anesthesia frequently produces ventricular fibrillation. Because this use of

The opinions or assertions contained herein are the private ones of the author and are not to be construed as official or reflecting the views of the Veterans Administration.

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1. Ehrenhaft, J. L.; Eastwood, D. W., and Morris, L. E. Analysis of twenty-seven cases of acute cardiac arrest. J. Thorac. Surg. 22:592 Dec. 1951.

2. Weinberger, L. M.; Gibbon, M. H. and Gibbon, J. H. Temporary arrest of circulation to central nervous system. Physiologic effects. Arch. Neurol. & Psychiat. 43:615 April 1940.

3. Corff, M. Cardiac arrest during surgery. Am. J. Surg. 82:683 Dec. 1951.

4. Dale, A. D. Cardiac arrest. Ann. Surg. 135:376 March 1952.

5. Bonica, J. Role of anesthesiologist in management of cardiac arrest. Current Res. Anesth. 31:1 Jan.-Feb. 1952

6. Holloway, C. K., Jr. Surgical considerations in sudden cardiac arrest. U.S. Armed Forces M. J. 2:1497 Oct. 1951.

epinephrine is so effective, it has been used experimentally. Recent work at the University of Minnesota by the departments of surgery and physiology[7] has demonstrated that long periods of hypercapnia followed by a rapid return to normal hydrogen ion concentration in a high percentage of experimental cases resulted in ventricular fibrillation. This occurrence is termed the "posthypercapnic phenomenon." Other causes such as electric shock, trauma to the chest wall, toxic doses of digitalis or quinidine are unlikely to be encountered by the oral surgeon.

REFLEX STIMULATION OF THE VAGUS NERVE—Reflex stimulation of the vagus nerve may occur when a patient is intubated while under too light a plane of anesthesia, during manipulations in the pharynx, or after pressure on the carotid sinus. This phenomenon is characterized by a definite bradycardia which terminates in cardiac standstill. The presence of hypoxia is generally thought to potentiate the effect.

MYOCARDIAL ISCHEMIA—Coronary occlusion, myocardial depression from toxic drugs such as occurs in cases of anesthetic overdose, and drug idiosyncrasies are examples of myocardial ischemia.

The thought that the surgeon must bear in mind is that cardiac arrest can occur without regard to the type of operative procedure, the anesthetic agent used, or the general physical state of the patient.[1] Therefore, he must be on guard constantly.

■ *Diagnosis*

Since diagnosis must be rapid, elaborate diagnostic measures cannot be undertaken. The most evident signs must be sought. These signs are apnea, imperceptible pulse, imperceptible blood pressure and inaudible heart sounds. If these conditions are present, cardiac arrest has almost certainly occurred. Other diagnostic signs include sudden cyanosis followed by a mottled, diffuse, ashen-gray color, widely dilated pupils, and absence of bleeding or pulsations at the operative site.

■ *Therapy*

When cardiac arrest occurs, treatment must be instituted without hesitation. Therefore, it is mandatory that the surgeon have a preconceived plan which he can follow.

Once the diagnosis of cardiac arrest is made, the following steps should be performed:

1. A clear airway must be established through which 100 per cent oxygen can be administered to the patient by intermittent positive pressure. Ideally, an endotracheal tube should be inserted, but if an adequate airway is present through which the patient can be oxygenated, time should not be spent on inserting a tube until the next step has been carried out.

2. Cardiac massage must be instituted simultaneously with the establishment of the airway and the administration of 100 per cent oxygen.

The left side of the chest is quickly painted with an antiseptic solution and is hastily draped. If material is not immediately available, the draping is disregarded. An incision is made in the fourth intercostal space, approximately just below

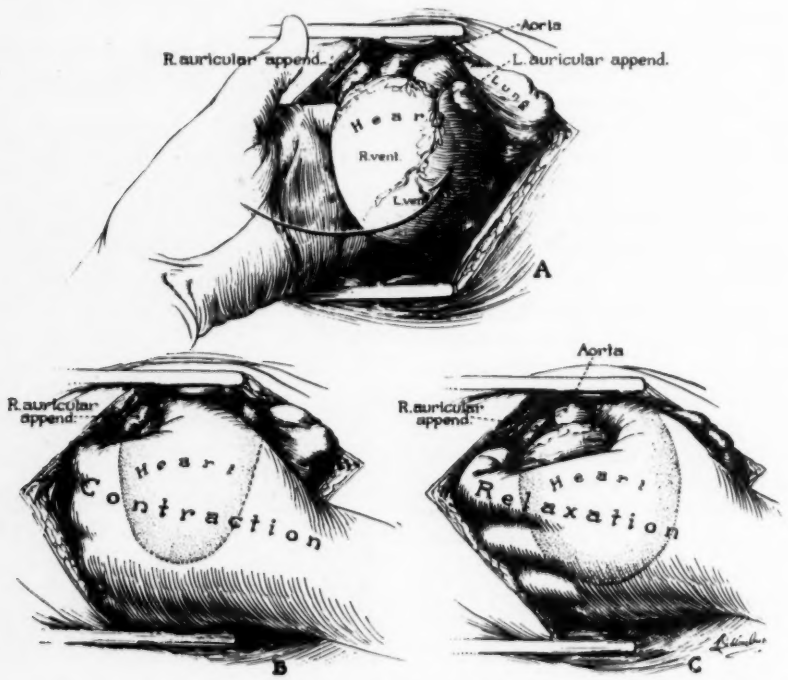
7. Miller, F. A., and others. Respiratory acidosis: its relationship to cardiac function and other physiologic mechanisms. Surgery 32:171 Aug. 1952.

the nipple, starting about one inch to the left of the sternum and continuing laterally to the midaxillary line. The fourth and fifth intercostal cartilages may have to be cut for access. The hand is inserted through the interspace and the fingers are placed behind the heart and the thumb in front[8] (see illustration). The optimal rate of massage is 120 times per minute. This, however, cannot be continued by one person for more than a few minutes. Kay[9] considers a rate of 50 per minute to be adequate. He also states that cardiac massage is most effective when employed through the open pericardium. If the heart is beating feebly, massage immediately after systole produces pressures of 10 to 15 mm. of mercury higher than if massage is done just prior to systole.[9]

3. The patient is placed in a Trendelenburg position to facilitate flow of oxygenated blood to the brain. Partial clamping of the aorta distal to the left

8. Bost, T. C. Cardiac arrest during anesthesia and surgical operations. Am. J. Surg. 83:135 Feb. 1952.

9. Kay, J. H. Treatment of cardiac arrest. Surg. Gyn. Obst. 93:682 Dec. 1951.



Demonstrating method of cardiac massage advocated for small hearts; two hands may be needed for large hearts. (Courtesy of Dr. J. Harold Kay, department of surgery, Johns Hopkins University, Baltimore, and by permission of Surgery, Gynecology and Obstetrics)

common carotid is advocated by some in order to enhance this effect.

4. Drug therapy is instituted. The amount and kind of drugs administered vary with the authority consulted. In Kay's studies only 50 per cent of 205 cardiac arrests artificially produced in dogs needed any drug at all. Most authorities, however, advocate small amounts of very dilute epinephrine in cases of ventricular standstill. One fourth cc. of 1:1,000 epinephrine solution diluted in 5 cc. of isotonic saline solution injected into the left ventricle is a moderate dosage. Because of its ability to greatly increase the irritability of the cardiac musculature, epinephrine should not be injected in cases of fibrillation. It is wise to withhold any drugs during the first few minutes of massage in order to allow the heart to take over on its own if it will.

Probably the only effective means of dealing with ventricular fibrillation is by the use of the electrical defibrillator. An electrode is placed on each side of the heart and a rapid succession of three to five shocks of 1 to 1.5 amperes and 100 to 120 volts is administered. This produces cardiac standstill which is treated in the manner described earlier. Procaine has been widely advocated in cases of ventricular fibrillation. Five to 10 cc. of 1 per cent solution is injected into the right auricle and into the pericardial sac.[3] This is said to lower the threshold of irritability of the heart. Certainly, in instances of ventricular fibrillation in which the electrical defibrillator is not available, it should be employed.

It is well to mention here that such drugs as nikethamide, pentylenetetrazol, alpha-lobeline, picrotoxin, and other convulsant drugs are condemned. They serve only to elevate cerebral metabolism and lead to cerebral anoxia.[4]

5. General supportive measures such as administration of intravenous fluids to maintain fluid balance, and the use of vasopressors to maintain blood pressure should be instituted if necessary.

■ *Summary*

Cardiac arrest constitutes the supreme surgical emergency. Diagnosis must be rapid and treatment immediate. The administration of oxygen through a clear airway simultaneously with the institution of cardiac massage are the two prime essentials of adequate therapy. Electrical defibrillation usually is necessary in cases of ventricular fibrillation although procaine injected into the cardiac chambers and pericardial sac may be effective. Small amounts of very dilute epinephrine solutions may be injected in cases of cardiac standstill but is contraindicated in cases of ventricular fibrillation.—*905 Medical Arts Building.*

■ Human Needs

The greatest skills we need are not in science or engineering, but in human relations.—*Cornelis W. de Kiewiet, "Education for Survival," The Scientific Monthly 76:61 February 1953.*

Use of trichloroethylene and thiamylal sodium as adjuncts to other anesthetics in oral surgery

■ *Fred W. Clement, M.D., Toledo, Ohio, and Harry M. Seldin, D.D.S., New York*

The use of an adjunct with nitrous oxide-oxygen for the production of anesthesia in dental operations is widespread. It is indicated especially for the treatment of the resistant type of patient—the alcoholic, the drug addict, the athletic or vigorous, muscular individual. Its use simplifies the administration of an anesthetic to young children and to debilitated individuals.

Adjuncts in common use are (1) ether, (2) vinyl ether (Vinethene) and (3) intravenous barbiturates. A recent addition, and a valuable one, is trichloroethylene, U.S.P. The disadvantages of ether are irritating odor, stimulation of mucus, slow absorption and elimination, and nausea. Vinyl ether is toxic in nature; it may cause salivation, postanesthetic headaches and nausea (far less than ether does); it is inflammable. The intravenous barbiturates, such as thiopental sodium (Pentothal Sodium), pentobarbital sodium (Nembutal Sodium) and thiamylal sodium (Sodium Surital) are excellent adjuncts for use in prolonged surgical procedures and for debilitated patients.

■ *Trichloroethylene, U.S.P.*

The use of trichloroethylene in anesthesia is not new since this drug was employed for years in Great Britain and in other parts of Europe. D. E. Jackson[1] of Cincinnati was the first in the United States to use it as an anesthetic agent. It has been used extensively for analgesia in obstetrics and also as an adjunct in gas anesthesia.

The formula for trichloroethylene is CHCl: CCl_2; its specific gravity is 1.47 and its boiling point 86 to 88°C. It is a clear, volatile liquid with an odor similar to chloroform but without its pungency. Impure trichloroethylene is used extensively in the commercial field for various purposes. For use in analgesia and anesthesia only the U.S.P. grade may be employed. It should be stored in a dark bottle or container.

Trichloroethylene may be heated without decomposition; but the vapor, diluted with air and exposed to a naked flame, breaks down to form hydrochloric acid and phosgene. It should not be used with soda lime in a closed circuit for the purpose of anesthesia.[2]

Trichloroethylene resembles chloroform in its action but is less potent and only

1. Jackson, D. E. Studies of analgesia and anesthesia, with special reference to such substances as trichloroethylene and vinesthene (divinyl ether), together with apparatus for their administration. Anesth. & Analg. 13:198 Sept.-Oct. 1934.

2. Carden, S. Hazards in the use of closed-circuit technique for trilene anesthesia. Brit. M.J. 1:319 March 4, 1944.

slightly toxic. It is absorbed through the mucous membrane of the respiratory tract and excreted from the lungs in the expired air. A small amount is excreted in the urine. Trichloroethylene vapor when inhaled produces excellent analgesia rapidly without any serious side reactions. It produces anesthesia in a proportion of 0.5 to 1.5 per cent of the total volume inhaled.

EFFECTS—The effects on the cardiovascular system[3] are as follows: There is no significant change in blood pressure. The effect on the pulse rate varies. Bradycardia, or less often tachycardia, is associated with overdosage. Arrhythmias are fairly common but usually of little significance because dental anesthesia is of short duration and minimal dosage is employed. C. R. Stephen of Duke University has advanced the theory that since trichloroethylene is similar in structure to chloroform it might sensitize the heart to epinephrine and thus cause ventricular fibrillation. Because of the insignificant amounts of epinephrine in vials of procaine or lidocaine, as used in dentistry, its effect on the heart's sensitivity in trichloroethylene anesthesia is greatly to be questioned. Primary cardiac failure is apparently extremely rare.

The effects on the respiratory system are as follows: There is little or no irritating effect on the respiratory passages and hence no excessive secretion of mucus. Rapid and shallow respirations—up to 50 per minute—are evidence of overdosage. Tachypnea also may be caused or aggravated by oxygen deficiency in the anesthetic mixture. Slow, quiet respirations with occasional stridor are evidence of underdosage.

The effects on the central nervous system are as follows: Analgesia occurs first and is followed by loss of consciousness. During analgesia, tingling of the scalp, the face and the limbs and numbness may be experienced. Cases of cranial palsy reported in connection with the use of trichloroethylene are thought to have been due to the formation of toxic products resulting from decomposition when the drug is used with soda lime in a closed circuit.[2]

ADVANTAGES—The advantages of trichloroethylene are as follows: (1) Both absorption and excretion are rapid. (2) The odor is not unpleasant. (3) The drug is nonirritating and does not cause excessive salivation or mucus. (4) Nausea is uncommon. (5) The drug is nonexplosive and noninflammable at ordinary temperatures and pressures. (6) It is inexpensive. (7) It does not cause any liver or kidney damage.[4]

METHODS OF USE—A small amount of trichloroethylene (1 to 6 tablespoons) is placed in the ether vaporizer—a surprisingly small amount ordinarily suffices for a single case. Removal of the wick in the vaporizer is optional. If the wick is left in place, better and more rapid vaporization results.

Induction with nitrous oxide-oxygen is performed in the usual manner. As soon as the patient is unconscious, the ether vaporizer control is turned on; and

3. Barnes, C. G., and Ives, J. Electrocardiographic changes during trilene anaesthesia. Proc. Roy. Soc. Med. 37:528 July 1944.

4. Wyngaarden, J. B., and others. Anesthetic properties of several thiobarbiturates in dogs. Federation Proc. 6:388 March 1947.

the trichloroethylene vapor is added gradually to the mixture. The effect of trichloroethylene is noted by observation of the pulse and respiration. If tachypnea (rapid breathing) and bradycardia (slow pulse) give evidence of overdosage, the trichloroethylene is cut off and the oxygen in the mixture is increased. It is seldom necessary to advance the ether control valve past the half-way mark. Even the patient of the resistant type usually "quiets down" after 10 to 12 breaths of the trichloroethylene mixture. As soon as the patient is quiet and his breathing is regular and full, the mouth inhaler is removed; the nasopharyngeal tube airway and mouth pack are inserted; and the operation is commenced.

At this point the trichloroethylene is reduced, and the oxygen in the mixture is increased as much as possible without bringing about too light a plane of anesthesia. If the patient proves difficult to control, more trichloroethylene can be added to the mixture. Trichloroethylene should be used as an adjunct to the gas and oxygen, not as a substitute. It is an analgesic agent, not a muscle relaxant and should be employed accordingly. The use of minimal amounts ensures a more rapid postoperative recovery.

As the operation nears its close, the trichloroethylene, if still in use, is discontinued; and the percentage of oxygen is increased. When the operation is completed, 100 per cent oxygen should be administered until the patient shows signs of consciousness.

The addition of ether to trichloroethylene as an adjunct with nitrous oxide-oxygen is of questionable value. Such a combination produces an explosive mixture with no better anesthetic properties than trichloroethylene alone.

■ *Thiamylal Sodium (Surital Sodium)*

The barbiturates constitute one of the best basal anesthetic agents for the production of anesthesia in a dental office. Many of these compounds have already been prepared, and in time there will be many new ones. No single thiobarbiturate constitutes the ideal anesthetic agent to the exclusion of all others. For the production of anesthesia in a dental office an intravenous barbiturate should be of the ultra-short-acting group, should cause the minimum postanesthetic depression and should produce a maximum desensitization of the larynx in order to avoid laryngospasm.

After several thiobarbiturates had been used in surgery for ambulatory patients, thiamylal sodium was found by the authors to be the most satisfactory. The course of anesthesia is smooth. Laryngospasm occurs rarely and is readily controlled with oxygen under pressure. The induction is pleasant and rapid, and the recovery period is briefer than with the other thiobarbiturates. Thiamylal sodium is useful as an induction agent for nitrous oxide-oxygen and as an adjunct to nitrous oxide-oxygen in prolonged anesthesia.

Thiamylal sodium is supplied in ampules as a dry sodium salt which, when dissolved, gives a clear aqueous alkaline solution. Helrich[5] and associates state that thiamylal solution can be kept for as long as 14 days without apparent loss of

5. Helrich, M.; Papper, E. M., and Rovenstine, E. A. Surital sodium: a new anesthetic agent for intravenous use; preliminary clinical evaluation. Anesthesiology 11:33 Jan. 1950.

potency or change in appearance. Its potency is about 1.5 times that of thiopental sodium. Administration is by intermittent intravenous injection or by continuous intravenous drip.

The dosage of any intravenous thiobarbiturate varies with the individual. The amount of thiamylal sodium necessary to induce hypnosis by intravenous injection varies from 4 to 10 cc. of a 2.5 per cent solution. It is injected slowly, intravenously with a 20 gauge needle. Anesthesia is continued with fractional doses of 0.5 to 1 cc. as indicated, supplemented by nitrous oxide-oxygen with a minimum of 20 per cent oxygen.

The dosage required to produce hypnosis by the continuous intravenous drip of the 0.4 per cent solution usually varies between 30 to 50 cc. This quantity is infused rapidly with an 18 or 19 gauge needle. The rate of flow during maintenance, however, is related to the signs of anesthesia. A minimum of thiamylal sodium is used; nitrous oxide-oxygen is the main agent during maintenance. Children require proportionately larger doses than do adults. The 0.4 per cent solution is preferable for the production of anesthesia in a dental office because it gives better control of the rate of administration and overdosage is more easily avoided. For the production of anesthesia in a dental office the maximum dose is 1 Gm. or 40 cc. of the 2.5 per cent solution or 250 cc. of the 0.4 per cent solution. Helrich and others report the use of 3.5 Gm. without severe depression.[5]

ADVANTAGES—The advantages in the use of thiamylal sodium are as follows: (1) Thiamylal sodium has a shorter pharmacologic action and a lesser cumulative effect than does thiopental sodium. (2) It causes less postanesthetic depression. (3) Laryngospasm is rare. (4) According to the statement of Wyngaarden[4] and his associates in a study of the cardiotoxic effect of thiobarbiturates, thiamylal sodium in equivalent doses is somewhat less toxic than thiopental sodium. (5) Recovery is rapid. (6) Nausea and other undesirable postanesthetic reactions are infrequent. (7) Induction is rapid, smooth and pleasant.

Virtue and Gootee[6] in an experiment on cats stated that "Nembutal produced more respiratory difficulty in cats than did pentothal. Respiratory difficulties were greater when seconal was used than when surital was employed in cats, and those following amytal were more numerous than with thioethamyl."

INDICATIONS—For the resistant patient the 2.5 per cent solution employed as a basal anesthetic in conjunction with nitrous oxide-oxygen produces a smooth anesthetic result without the stormy induction that may occur with nitrous oxide-oxygen alone.

In prolonged oral surgical procedures for the normal and for the debilitated patient, an intravenous infusion of a 0.4 per cent solution of thiamylal sodium as an adjunct followed by nitrous oxide-oxygen produces a balanced anesthesia that is safe and an induction that is pleasant. The induction period can be shortened by injecting a 2.5 per cent solution

6. Virtue, R. W., and Gootee, J. E. Experimental and clinical evaluation of sodium allyl 1-methylbutyl barbiturate (Seconal) administered intravenously. Anesthesiology 12:642 Sept. 1951.

into the rubber tubing carrying the 0.4 per cent infusion.

CONTRAINDICATIONS—The chief contraindication is any severe obstruction in the respiratory tract, due to tumors or edema from infections in the floor of the mouth or neck. Most barbiturates are detoxified mainly by the liver and, therefore, should not be used for patients with severe hepatic diseases.

PREPARATION OF SOLUTIONS—Strict asepsis must be maintained. The equipment consists of a 20 cc. syringe, a 20 gauge needle, an 18 gauge needle, 1 Gm. thiamylal sodium and a 250 cc. flask of sterile isotonic sodium chloride.

The procedure consists of the following steps: (1) Any excess is removed from the flask of sterile sodium chloride so that only 250 cc. remains. This excess is discarded. (2) The thiamylal sodium powder is dissolved by the addition of 10 cc. of saline solution injected directly into the vial. (3) The thiamylal sodium and the saline solution are mixed thoroughly. This mixture is withdrawn into the syringe and is added to the flask containing the saline solution. (4) The bottle is labeled with the date and the concentration of solution (thiamylal sodium 0.4 per cent).

For the preparation of a large amount such as 250 cc. of the 2.5 per cent solution, 5 Gm. of thiamylal sodium (five vials) are used; and the same procedure is followed as for the 0.4 per cent solution.

For the preparation of 40 cc. of the 2.5 per cent solution, a 50 cc. ampule of sterile distilled water may be used instead of the saline solution (1 Gm. in 40 cc. for 2.5 per cent solution). The steps in this procedure are as follows: (1) From the 50 cc. of water in the ampule 10 cc. is withdrawn and discarded; 40 cc. is left. (2) An additional 10 cc. is withdrawn and injected into the 1 Gm. bottle of thiamylal sodium, and the water and the thiamylal sodium are mixed. (3) The solution is withdrawn from the bottle of thiamylal sodium and added to the open ampule of sterile water. (4) The ampule is labeled with the date and the concentration (thiamylal sodium 2.5 per cent).

ADMINISTRATION—The following is a description of the production of anesthesia by intravenous infusion with a 0.4 per cent solution.

The intravenous tray or table should contain all the necessary equipment: thiamylal sodium solution, disposable tube needles, alcohol, sponges, adhesive tape, tourniquet and scissors.

Before the administration is begun, a history of the patient's physical condition including any possible allergic manifestations is obtained. The disposable tubing is attached to the flask containing the thiamylal sodium solution, and the flask is suspended from a stand or hanger. The level and the amount of solution in the bottle are carefully checked; care is taken to ensure that the flow is restricted by the tube clamp. After the patient's arm is secured on the armrest attached to the chair, the tubing is filled with solution and an 18 or 19 gauge needle is attached. A tourniquet is then applied, and the patient is instructed to open and close his fist. The vein area is sponged with alcohol, and venipuncture is done by means of a sharp needle with its bevel directed upward. The tourniquet is now released, and

the patient's fist is opened. The needle is fastened securely in position with adhesive tape, and the fluid (30 to 50 cc.) is allowed to run in until the patient is too drowsy to react to simple stimuli.

When the patient shows signs of light anesthesia—movement of the eyeballs, nystagmus or increase in depth of respiration—the rate of flow is decreased to about 40 to 60 drops per minute. The nasal inhaler is applied, and nitrous oxide is started with 40 to 50 per cent of oxygen. The depth of anesthesia is controlled by the rate of drip and the percentage of nitrous oxide.

The patient is now ready for surgery. The oxygen percentage is varied in accordance with the signs of anesthesia. When the surgery is nearly complete, the flow of thiamylal sodium is shut off. As the patient begins to react, the needle is removed from the vein; and 100 per cent oxygen is administered until the patient is conscious.

In the administration of the 2.5 per cent solution, the vein is entered with a 20 gauge needle; and 3 to 5 cc. of the solution is injected rapidly. Unconsciousness usually occurs in about 30 seconds. If not, fractional doses of 0.5 to 1 cc. are added as indicated. A short period of apnea may occur after the initial administration. When light anesthesia is established, the nasal inhaler is applied; and nitrous oxide-oxygen is administered. The depth of anesthesia is controlled by administering further fractional doses of thiamylal sodium or by increasing the percentage of nitrous oxide. It is always better to err on the side of caution. Additional solution can always be injected; but once any surplus solution has entered the bloodstream, it is impossible to withdraw it.

COMPLICATIONS—Barbiturates have practically no analgesic action. In hypnotic doses they cause little metabolic disturbance. In heavier doses, however, they act as respiratory depressants and may produce respiratory failure. This failure is followed by a collapse of the cardiovascular system. In inhalation anesthesia the patient's reactions clearly warn of overdosage, but when the anesthetic is given intravenously such warnings are not as evident.

If overdosage becomes evident, artificial respiration with oxygen is administered until the excess of thiamylal sodium is detoxified. The use of supportive drugs is of questionable value. Metrazol, nikethamide and picrotoxin counteract respiratory depression by direct action on the central nervous system while ephedrine and Aranthol increase the contraction of the heart and arterial pressure.[7] There is no specific drug for barbiturate overdosage; the value of analeptics is still controversial. Laryngospasm also is treated by the administration of oxygen under pressure.

The so-called ultra-short-acting barbiturates produce anesthesia of short duration only when administered in small doses. In prolonged anesthesia when repeated injections are made, they no longer behave as ultra-short-acting drugs. Brodie and others[8] found that the concentration

7. Boniface, Kenneth J., and Brown, John M. Quantitative evaluation of cardiovascular-stimulant drugs in barbiturate depression of the heart of the dog. Anesthesiology 14:23 Jan. 1953.

8. Brodie, B. B., and others. Intravenous anesthetics; new concepts. I. Experimental aspects. Current Researches in Anesth. & Analg. 31:145 May-June 1952.

of the thiobarbiturates in the plasma falls rapidly after the injection of a single small dose and that the patient recovers rapidly but that repeated fractional doses become cumulative. The drug metabolizes slowly at the rate of 10 to 15 per cent per hour. These authors state also that the early sharp decline in the concentration of the thiobarbiturates in the plasma is not due to fast metabolism but rather to their distribution in the body tissues, especially in fat. Fat stores up to 70 per cent of the administered dose and achieves a concentration of six to 12 times that of plasma. To quote Brodie and others,[8]

> The slow rate of transformation to thiopental is contrary to the generally accepted belief that the drug is ultra-short-acting because the body rapidly degrades it. Ultra-short action of thiopental following a small dose is explained not by its rapid metabolism, but by its rapid localization in fat. The plasma level of anesthetic after diffusion equilibrium between tissues and fat is established, is below that necessary for anesthesia and the subject awakens soon after injection. After a large dose of the drug, however, or after repeated small doses, the resulting equilibrium plasma level is above the anesthetic level and is maintained there by the reservoir of drug in the fat. Because of slow metabolism of thiopental, anesthesia continues for a considerable period of time.

All short-acting barbiturates are stable in the body and become cumulative in the tissues, especially in the fat tissues. Because of this, larger doses produce postoperative depression and prolonged somnolence. After large doses the patient, especially the very old or the very young, is in danger of severe depression. Asphyxia resulting from aspirated vomitus must be guarded against. All things being equal, the degree of postanesthetic depression is in direct proportion to the total dose of the barbiturate. This is true regardless of the method of administration. It is for this reason that at present we use the minimum dose of the thiobarbiturate by dilute intravenous drip and discontinue the flow soon after induction. The anesthesia is continued with nitrous oxide-oxygen.

For prolonged oral surgery, thiamylal sodium supplemented with nitrous oxide-oxygen is much safer and produces more gratifying results than thiamylal sodium alone. The patient is less depressed and become ambulatory more quickly if the barbiturate is kept at a low plasma level and if the maintenance of anesthesia is controlled by the nitrous-oxide oxygen.

■ *Conclusion*

The choice of an anesthetic agent is determined largely by the physical condition of the patient. Certain patients may prove resistant to nitrous oxide-oxygen alone. Such patients are easily anesthetized by the addition of an adjunct to the gases. Thiamylal sodium and trichloroethylene are excellent adjuncts for use with nitrous oxide-oxygen in the dental office.—2228 *Ashland Avenue.*

Management of teeth in the line of mandibular fracture

■ *Charles A. Wilkie, D.D.S., Brooklyn; Alfonso A. Diecidue, M.D., Tampa, Fla., and Richard J. Simses, D.D.S., Bridgeport, Conn.*

Many authorities on the management of mandibular fractures have advised the early, routine extraction of all teeth in the line of fracture. This advice is based on the fact that the teeth whose apexes are in a fracture line are devitalized by the trauma and they act as a predisposing factor to infection of the compound fracture line, with the end result of osteomyelitis or nonunion. The introduction of antibiotic drugs to the clinician's armamentarium, however, has radically reduced the incidence and severity of odontogenic infections. It is therefore proper to reconsider the question of teeth in the line of mandibular fractures, keeping in mind these new therapeutic aids.

If teeth can be retained in a mandibular fracture line without causing any increased incidence of infection or nonunion, the following advantages are realized: (1) The teeth may be used for reduction and fixation of the osseous fragments. (2) Additional trauma, displacement and compounding of the fractured bone is avoided. (3) The use of complex methods of treatment such as open reduction or external pin fixation is obviated when strategic teeth are involved in the posterior segment. (4) Strategic teeth can be preserved by subsequent endodontic procedures for use as abutments in restorative dentistry.

The benefits derived from the retention of teeth in a mandibular fracture line are most striking when that tooth is either the only tooth in the posterior fragment or when it functions as a keystone for the maintenance of good position. The advantages outlined are sufficiently significant to contraindicate the indiscriminate sacrifice of teeth in the line of fracture if it can be demonstrated that the retention of these teeth is not accompanied by an undue incidence of complications or sequelae.

■ *Clinical Material and Findings*

For the past seven years at Kings County Hospital, teeth in the line of mandibular fractures have been retained if they were considered to be useful in the reduction or fixation of the fracture. Extremely mobile teeth, teeth with large periapical regions of radiolucency and badly fragmented teeth have been removed at an early date, but others have been allowed to remain *in situ*. Patients

Presented before the Clinical Program, American College of Surgeons, Kings County Hospital, Brooklyn, September 24, 1952.

This work was initiated by the late Walter A. Coakley, M.D., former director of the department of plastic and reconstructive surgery, Kings County Hospital. Acknowledgment is given to David Teplitsky, M.D.; Gerald O'Brien, M.D., and Raymond Shapiro, M.D., D.D.S., for their contribution to this report.

From the department of plastic, reconstructive and maxillofacial surgery and the department of oral surgery, Kings County Hospital, Brooklyn.

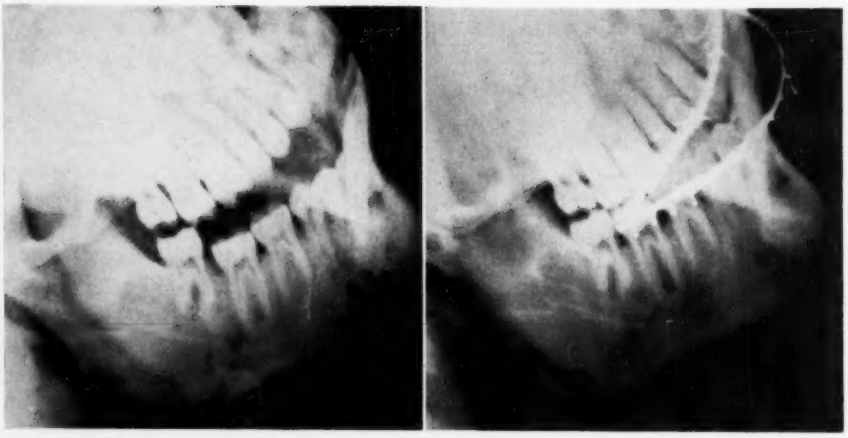


Fig. 1—Left: Fractured mandible. Posterior segment contains third molar. The segment is displaced upward. Right: Tooth was maintained; on fixation third molar was brought into occlusal plane thereby forcing posterior segment into perfect alignment

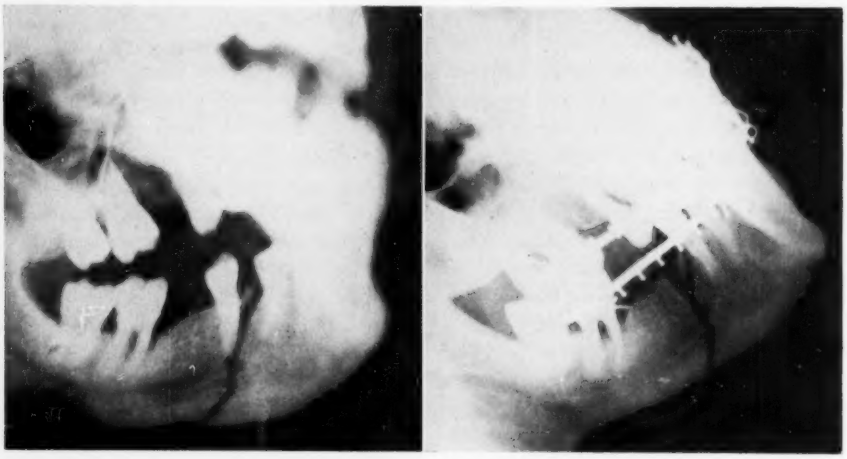


Fig. 2—Left: Fractured mandible involving second bicuspid with upward displacement of posterior segment. Right: Tooth was removed because of extreme mobility. Good position was achieved through intraoral fixation since posterior molars were present

who have had teeth in the line of fracture have received at least one week of parenteral penicillin therapy, starting at the time of their hospital admission, and in most instances the teeth in question have been extracted as a prophylactic measure after good bony union had been obtained.

In order to check on the clinical management of these cases, 250 fractures of the mandible treated consecutively at Kings County Hospital were reviewed. Of these 250 cases, 190, or 76 per cent, had teeth involved in the line of fracture. In 145 of these cases, the teeth in the line of fracture were retained. Eleven of these patients subsequently required open reduction, but 134, or 92.4 per cent, obtained good healing of their fractures without operative procedures and without major complications.

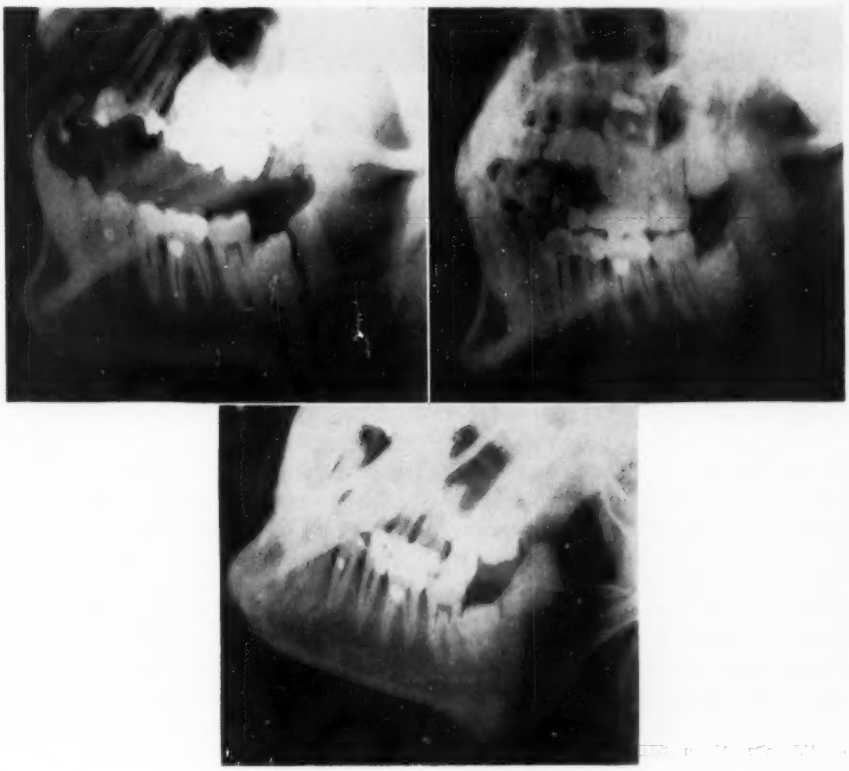


Fig. 3—Left: Impacted third molar in line of fracture which prevents upward displacement of posterior segment. Tooth was maintained in place. Right: Adequate alignment with intraoral fixation. Below: Immobilizing appliance removed eight weeks later. Impaction caused no interference with healing

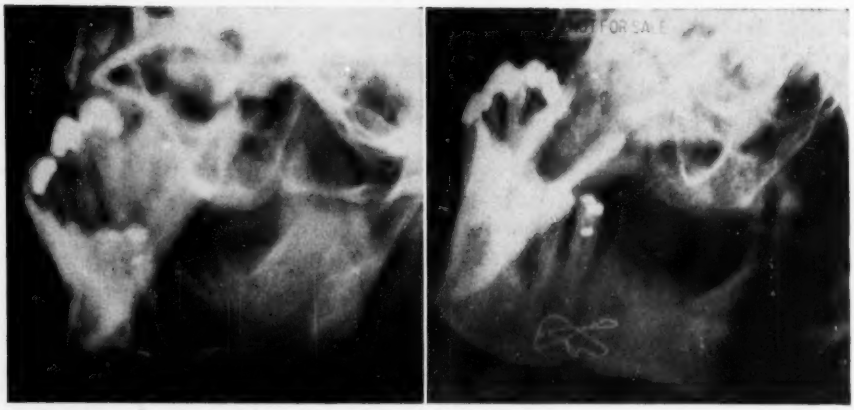


Fig. 4—Left: Cariously involved second bicuspid was in line of fracture and was maintained. Right: Open reduction was performed. Seven weeks later with the jaw functioning, tooth remained in place and asymptomatic

The 45 patients who had teeth extracted from the line of fracture required open reductions in 28 instances, or 62.2 per cent.

The incidence of infection and osteomyelitis in the 250 cases was nil.

The following schedule of antibiotic therapy has been found to be successful. One hundred thousand units of aqueous penicillin is given every four hours for the first four days after admission. This is followed by 300,000 units of procaine penicillin daily for the succeeding six days. At about the tenth day, the patient is discharged and he receives 300,000 units of procaine penicillin weekly for the remaining period of immobilization. Occasionally penicillin is injected into the fracture site. Recently oxytetracycline has been used for those patients who exhibited sensitivity to penicillin.

Figures 1-4 illustrate certain salient features of this discussion.

■ *Summary and Conclusions*

A review of 250 patients with mandibular fractures has shown that it is perfectly safe to retain a tooth in the line of a mandibular fracture if proper antibiotic therapy is administered, and if the patient is kept under adequate observation until the fracture has healed. After union is firm, the teeth in question may be removed or receive proper endodontic treatment in order to prevent the development of an alveolar abscess at some future date. That there is a clear-cut advantage in using teeth in the line of fracture is demonstrated by the fact that open reductions are used much more frequently when teeth have been sacrificed prematurely.

The use of antihistamines in oral surgery: a preliminary report

■ *Roland E. Silverman, D.D.S., Tiffin, Ohio*

There has been astounding progress in the fight against disease and death during the past 15 years. Indeed, the history of medicine and surgery for the previous hundred years is an enviable one, and the future gives an even greater promise of success. Oral surgeons play an important part in the advancement of science. They are obligated, therefore, to be familiar with a bewildering array of current literature. It is difficult, even in the restricted field of oral surgery, to keep abreast of the newly developed drugs and the constantly changing methods in anesthesia. Yet, as the new drugs and new methods are made available they must be appraised if the profession is to continue its progress.

Seven months ago, during the surgical treatment of several patients who were undergoing antihistamine therapy for allergies, there were indications that antihistamines were of value. Since that time an investigation has been carried out which suggests that these drugs offer possibilities in the field of oral surgery. It was observed that their use prior to general anesthesia noticeably improved the postanesthetic course and also appeared to add greatly to the safety of the anesthesia. When administration of antihistamines was continued postoperatively there was a tremendous reduction in the incidence and intensity of pain, a shortening in healing time and a considerable reduction in tissue slough.

The data to be presented is empirical to a considerable extent. Antihistamines were used in connection with surgical procedures with results which have not been previously reported in the literature.

It should be clearly understood that this is a preliminary report, and much remains to be accomplished. The apparent implications for their adjunctive use in oral surgery and anesthesia, however, and the many possible ramifications when used in connection with general surgery and in anesthesia for general surgery make it imperative that this information be released to the profession at the earliest possible moment.

As a background to this report, a short review of the role of histamine in anesthesia and surgery will be given. In the report on anesthesia it will be noted how many of the postanesthetic complications parallel the symptoms produced by histamine intoxication. Also it will be noted that in the report on antihistamines in surgery, histamine release after trauma is by now a fairly well established fact.[1]

Read before the American Society of Oral Surgeons, October 10, 1952, New Orleans, La.

1. Kessler, M. M. Antihistaminics in treatment of burns; preliminary report. Indust. Med. 20:42 Jan. 1951.

■ *Histamine*

The following report on histamine is based, to a great extent, on the work of Best and Taylor[2] and Goodman and Gilman.[3]

Histamine is derived from histidine which is one of the 11 amino acids essential to growth. The loss of one carbon dioxide radical from histidine results in the formation of histamine. It was identified by Best[4] in 1927 as being present in normal tissues. It is present in all tissues although its method of formation has not been established. Evidence now available suggests that histamine plays an unimportant physiological role.[5]

It is abundantly present in the lungs. The concentration in human blood averages 3.5 to 4.5 micrograms per 100 cc. It is probably contained in the white blood corpuscles and most probably in the eosinophils. Blood platelets are rich in histamine content.

One microgram of histamine causes a sharp fall in blood pressure in an unanesthetized man. Anesthetized individuals are even more susceptible. In blood vessels, histamine causes a vasodilatation of arterioles and capillaries. This effect is independent of innervation and is not blocked by atropine. With sufficient histamine release, the permeability of the vessels is altered, resulting in a transudation of plasma protein and fluid into the extracellular spaces. When it gains access to the circulation, all the capillaries of the body participate in the reaction. Histamine release may be precipitated by the injection of any foreign substance into the blood stream and is initiated by the reaction of the substance on the endothelial cells lining the vessels.

After the transudation of fluids from the vessels there occurs a hemoconcentration and reduction of blood volume. By reflex this brings about an increase in cardiac output and rate, but there is no apparent effect on the heart muscles directly.

Histamine release increases oxygen consumption. There is a constriction of the bronchioles of the lungs by direct muscular action unrelated to innervation and uninfluenced by atropine. Vandam[6] states that in the so-called bronchospasm of asthma or the bronchospastic response to histamine, irritants or parasympathomimetic drugs such as thiopental sodium, air exchange literally may be shut off.

Holtz and Heise[7] in 1937 stated that a more or less severe oxygen deficiency seems to be an important factor in histamine production in physiological as well as pathological conditions. Blood histamine increase can return to normal in one or two minutes. Increases have been noted, however, for as long as ten minutes after hypoxia.[8]

Graf[9] has indicated that the mechanisms leading to histamine release from

2. Best, Charles H., and Taylor, Norman B. The physiological basis of medical practice, ed. 4. Baltimore, Williams & Wilkins, 1945.

3. Goodman, Louis, and Gilman, Alfred. Pharmacological basis of therapeutics. New York, Macmillan Co., 1941.

4. Best, C. H., and others. The nature of the vaso-dilator constituents of certain tissue extracts. J. Physiol. 62:397 March 1927.

5. Loew, Earl R. Symposium on medical therapeutics; antihistaminic drugs. M. Clin. North America, Nationwide Number 34:351 March 1950.

6. Vandam, Leroy D. The functional anatomy of the lung. Anesthesiology 13:130 March 1952.

7. Holtz, P., and Heise, R. Uber Histaminbildung im Organismus. Arch. f. exper. Path. u. Pharmakol. 186:377, 1937.

8. Eichler, O.; Speda, G., and Wolff, E. Ueber die Histaminwerte im Blutplasma bei Anoxamie. Arch. f. exper. Path. u. Pharmakol 202:412, 1943.

9. Graf, Wilhelm. Studies of endogenous histamine in clinical and experimental hypoxaemia. Acta Paediat. 38:180, 1949.

cells into the blood or to an increase in tissue histamine are largely unknown. Certain findings, however, point to the existence of a relationship between insufficient tissue oxygenation and the factors influencing the output of histamine from cells. Dissimilar findings have been encountered by the various investigators in their work on the pharmacology and physiology of histamine, emphasizing the obscurity which surrounds this substance.

Gastrin, the hormone of the pyloric glands of the stomach, and histamine are indistinguishable. An injection of 0.25 to 0.50 mg. of histamine brings a copious flow of gastric juices. This stimulation continues for approximately 30 to 90 minutes, after which there is a gradual return to normal of the free acidity of the stomach.

Histamine release in the cerebral vessels causes a dilatation of the pial vessels and increases the cerebrospinal fluid pressure. Flushing of the cortex through the transudation of fluid probably accounts for the intense transient headaches that result.

Symptoms of histamine intoxication or poisoning closely resemble the clinical signs of anaphylactic shock and include a precipitous fall in blood pressure, generalized vasodilatation, rise in body temperature and metabolic rate, intense headache, visual disturbances, bronchial constriction and dyspnea, metallic taste, vomiting and diarrhea.

Information is not available concerning the duration of histamine release after trauma. Loew[10] of Boston University states that there is suggestive evidence that histamine release continues over periods of hours or days after certain types of injury, although he personally feels that trauma, *per se*, does not cause appreciable amounts of histamine release.

■ *The Antihistamines*

The literature for the last several years has contained many reports on the clinical trial of the antihistamines, for the most part in connection with the allergy diseases. Varying clinical technics make it difficult to evaluate and compare the observations that were made. The usual procedure which has been adopted in the screening and evaluation of the antihistamines is to determine their ability to prevent bronchoconstriction which is so conspicuous in guinea pigs exposed to histamine or experiencing anaphylaxis.[11] One theory[5] is that the antihistamines in some manner adsorb onto cells and by some as yet undetermined mechanism prevent histamine from affecting cells in the usual manner. Thus, they would be considered blocking drugs like atropine. Another theory[12] is that antihistamines compete with histamine for a receptor substance or a site of action in a manner analogous to the antibacterial action of the sulfonamides.

There has been little investigation into the absorption, fate and excretion of the drugs. Absorption from the intestinal tract is rapid and excretion also must be fairly rapid since therapeutic effects can be maintained only if dosages are given consistently. For most of these drugs the manner of inactivation and excretion is

10. Loew, Earl W. Personal communication, June 1952.

11. Loew, E. R.; Kaiser, M. E., and Moore, V. Synthetic benzhydrl alkamine ethers effective in preventing fatal experimental asthma in guinea pigs exposed to atomized histamine. J. Pharmacol. & Exper. Therap. 83:120 Feb. 1945.

12. Lilly, Eli and Co. De Re Medica, ed. 3, 1951.

unknown, although some work is now being reported in this field. No cumulative action has been reported, a fact which is compatible with the observation that duration of action is short.[13]

When the antihistamines are administered the most important actions of histamine are consistently blocked; namely, the spasm of smooth muscle, increased capillary permeability and dilatation of blood vessels.[5] They appear ideally suited for the specific control of those clinical conditions suspected of being caused by histamine. Thus they have become important as diagnostic agents in differential diagnosis.[13]

Therapeutic doses administered orally elicit no appreciable pressor or depressor responses and no tachycardia.[5] In recommended doses they have not been found to have an effect on respiration.[14] In animals, ability to respond to hypoxia was undiminished in tests with 100 mg. of antazoline hydrochloride, diphenhydramine hydrochloride and tripelennamine hydrochloride.[15]

There is no evidence that the drugs block any of the physiological functions of histamine if any such functions exist. Large doses have been given over long periods of time both to animals and humans without causing any symptoms or pathologic effects that could be ascribed to histamine blockade. There is no indication of chronic toxicity.[5]

The antihistamines are absorbed rapidly after oral or parenteral administration. Effects are noted in 20 to 45 minutes and persist for two to six hours in the shorter-acting drugs. In the longer-acting drugs effects are produced in one to two hours and are present for 12 to 24 hours. If symptoms are severe, the duration of effectiveness usually is shortened. If mild, the effects usually persist longer.[13]

Sedation is prominent among the side effects of the antihistamines. Other side effects noted in the literature include nervousness, dizziness, weakness, nausea, diarrhea, tremors, headache, dryness of the mouth and excitation. The majority of patients report no side effects.[13] Patients who complain of epigastric distress after oral administration should be given milk or fruit juices with subsequent doses of the drug.[5] Oddly enough, Brown[16] reported that similar or identical side effects were reported by the same percentage of patients who were given placebos. Weiss and Howard[17] also noted that 18 per cent of the patients receiving placebo tablets complained of drowsiness.

■ *Observations*

The following observations are tentative and are not to be construed as final conclusions.

The anesthesia used in the study was of a balanced type consisting of 2 per cent thiopental sodium, nitrous oxide and, very occasionally, vinyl ether.

The following highly sedative drugs were tried: diphenhydramine hydrochloride, and promethazine; the moderately sedative were tripelennamine

13. Feinberg, S. M.; Malkiel, S., and Feinberg, A. R. The antihistamines. Chicago, Year Book Publishers, Inc., 1950.

14. Feinberg, S. M. Report to Council on Pharmacy and Chemistry: Histamine and antihistaminic agents; their experimental and therapeutic status. J.A.M.A. 132:702 Nov. 23, 1946.

15. Burkhardt, W. L.; Eastman, B. R., and Hale, H. B. Influence of antihistamines on respiratory response to hypoxia. J. Appl. Physiol. 3:29 July 1950.

16. Brown, S. F. Side reactions to pyribenzamine medication. Proc. Soc. Exper. Biol. & Med. 67:373 March 1948.

17. Weiss, W. I., and Howard, R. M. Antihistamine drugs in hay fever: a comparative study with other therapeutic methods. J. Allergy 19:271 July 1948.

hydrochloride, pyrilamine maleate, and prophenpyridamine; the least sedative were Pyronil, Co-Pyronil, and antazoline hydrochloride and tripelennamine hydrochloride.

Tripelennamine hydrochloride was finally selected as the preanesthetic drug of choice. The 100 mg. dose was more effective (Table 1) and was administered orally one hour before surgery. Atropine was used intravenously before the thiopental sodium. Narcotics were not used preoperatively or postoperatively. Only adults were considered in the series although all patients over 15 years of age were given this dosage. Children under 15 were given 50 mg. arbitrarily when thiopental sodium was used.

The diastolic pressures were followed and used for evaluation because they reflected the situation that existed in the capillary beds.

The maintenance of both the percentage of diastolic pressure rise and the average point pressure rise in the group which received 50 mg. and the group which received 100 mg. over that in the control group is interesting. It will be noted, however, that there was a reduction in the thiopental sodium used, in spite of the increased operating time, in the group which received 100 mg. over the other groups, and there was noticeable improvement in reaction time and a reduction of postoperative complications in the group which received 100 mg. Improvement in technic may have been a factor.

The reaction time was immediate in almost all cases in the last series in our study. Cerebration was rapid, with little disturbance of vision and few headaches. There was occasional vomiting of blood that had been swallowed, but this was transient. No apnea was observed. No hiccoughing, sneezing or tremors were observed during induction of the anesthetic. Rapid loss of consciousness with slow induction was possible. A lighter plane of anesthesia could be maintained. Indeed,

Table 1

Antihistamines in anesthesia

	Antihistamines none	Antihistamines* 50 mg.	Antihistamines* 100 mg.
Number of cases	74	95	123
Average age—years	32.7	33.1	32.4
Av. amt. 2% thiopental sodium—cc's	36.4	27.7	22.6
Av. operating time—min.	13.6	17.7	16.8
Diastolic pressures between preoperative and postoperative			
Higher	42 (56.7%)	79 (83.1%)	103 (83.7%)
Av. point rise	17.2	21.7	21.7
Same	26 (35 %)	12 (12.6%)	14 (11.6%)
Lower	6 (8.1%)	4 (4.2%)	6 (4.9%)
Av. point drop	13.2	15	13.3
Reaction time			
Immediate	49 (66.2%)	81 (85.2%)	120 (97.5%)
Moderate	10 (13.5%)	9 (9.4%)	3 (2.4%)
Slow	15 (20.2%)	5 (5.2%)	none
Postanesthetic complications	36 (48.6%)	15 (15.8%)	1 (0.8%)

*The antihistamines used were tripelennamine hydrochloride or diphenhydramine hydrochloride.

Table 2
Postoperative observations after extractions

	Simple		Difficult*		Impactions	
	Group†	Isolated	Group	Isolated	Simple	Difficult
50 mg. antihistamines administered preoperatively and postoperatively						
No. extractions	2,820	1,468	46	13	63	28
Sockets treated	7	27	0	1	4	11
Dry sockets	.25%	1.9%	0	8%	6.3%	38.4%
No antihistamines administered						
No. extractions	2,525	1,242	45	15	65	31
Sockets treated	11	46	0	4	16	29
Dry sockets	.43%	3.9%	0	27%	27.7%	96.8%

*Difficult: As defined by surgeon.
†Group: Teeth removed in segments.

the nasopharyngeal tube rarely produced coughing despite an extremely light plane.

The eyes were bright, pupils usually were centrally fixed and reacted to light. The anesthetic range with nitrous oxide-oxgen appeared widened.

The hypotensive individual showed increased diastolic pressure at the end of induction of thiopental sodium. The rise averaged 15 to 20 points. Although there were not a sufficient number of hypertensive individuals among the patients to make the observation of importance, those who were observed appeared to maintain their diastolic pressures with little fluctuation in the induction phase and without the rise seen in average subjects at reaction time.

■ *Antihistamines in Surgery*

A standard dosage was used with no regard at the time of administration for the age, weight, personality or degree of trauma. Each patient was given 3 tablets of 50 mg. each to be taken at retiring on the three successive nights after operation. This series was conducted by the Ewing Clinic and included adults only (Table 2).

A considerable reduction in postoperative complications will be noted in cases where antihistamines were used.

The next series involved 555 adult patients. An attempt was made in this group to determine the most efficacious drug with the fewest side effects and also to determine if possible the optimum dosage needed.

After trials with numerous drugs, it was established that the antihistamines Pyronil and Co-Pyronil were best suited for postoperative use. Pyronil is used on hypertensive patients because vasoconstricting drugs are contraindicated in these subjects. Both are long-acting drugs and generally both are well tolerated. In the observation of the postoperative course of extraction wounds it was noted that some failures occurred where antihistamines had been used only preoperatively. Fewer failures occurred when postoperative medication was used, diminishing in percentage as the medication was increased; however, the failures were not the slough-

ing sockets of old. Pain was the principal symptom, and when it was present the case was interpreted to be a failure.

It was finally established that the optimum dose involved the use of the drug every four hours. Four to twelve capsules were dispensed, the dose being varied on the basis of age, weight, personality and degree of trauma. In some cases, especially after the removal of deeply impacted third molars, additional medication was given for prophylactic reasons after the initial dosage. The frequency of administration, however, was reduced to one capsule every 8 to 12 hours for usually four to six doses.

Outstanding in the observations was the absence of slough. Pain, swelling, bleeding and trismus appeared substantially diminished. Healing by first intention occurred more frequently. When wounds healed by second intention, pain rarely was present and these wounds were untreated except in impaction areas. No drains were used and local treatment was used in only three cases in the entire series of 555 cases.

Dry sockets of long standing responded quickly to the drugs, with irrigation the only local treatment necessary. Again, diphenhydramine hydrochloride appeared to be the drug of choice. Its sedation, of course, was the principal objection to its use.

When it was necessary to change drugs during treatment, tripelennamine hydrochloride was the drug preferred as a substitute.

Neurotic individuals definitely required larger doses than average subjects. Of our 21 failures in the entire series, 16 occurred in neurotic individuals.

■ *Discussion*

Several questions pose themselves for consideration. Are dry sockets or ulcerations in the mouth prolonged, once established, because of continuing histamine release? For how long a period of time does histamine release continue? Does it continue until a natural barrier is established by the host at the site of trauma? Is it possible that alteration of cell physiology by histamine release is the cause of pain? Is the restriction of pain by the antihistamines brought about by direct action on histamine, or is it because of their local anesthetic properties? Is a dry socket an allergic response to an infecting organism? Is the lessened bleeding and swelling, if this observation is accurate, due to the increased capillary tone produced by the antihistamines?

In spite of these many theoretical questions, it is obvious to all of us involved in this study that the antihistamines are destined to play a prominent role in anesthesia and surgery in the future.

Surgical treatment of a complete unilateral fibrosis of the temporal muscle: *report of case*

■ *Carl F. Anderson,* D.D.S., and Leroy Smith,† M.D., Richmond, Va.*

Kazanjian[1] in a report of 33 cases of temporomandibular ankylosis stressed the importance of determining the presence or absence of horizontal jaw movements as a differential diagnostic procedure. He stated further than an ankylosis in which no forward thrust of the mandible was possible could be considered bilateral and of the intra-articular type but that an ankylosis in which a forward thrust of the mandible was possible could be considered of the extra-articular type. Five of the 33 cases he studied were of the latter type. Kazanjian believed that all his cases of ankylosis of the jaw were benefited by his surgical procedures.

Brown and his co-workers[2] in a report of 27 cases of ankylosis of the coronoid process of the mandible recommended the complete surgical removal of the entire coronoid process and part of the adjacent surrounding bone as the method of choice for alleviating the ankylosis. They advocated an intraoral approach for this operation since the possibility of postoperative complications involving the facial nerve and parotid gland structures would be greatly lessened.

Martin[3] in a report of two cases of ankylosis of the mandible concluded that the extensive fibrosis uniting the coronoid process, the sigmoid notch, the condylar neck and the zygomatic arch was the sequela of undiagnosed and untreated condylar fractures; he likewise recommended surgical treatment.

The case presented here is that of the unilateral, complete, extra-articular type of ankylosis.

CASE HISTORY—A 61 year old white male patient was transferred to the Veterans Administration Hospital at Richmond, Va., with a complaint that he was unable to move his jaw and with a provisional diagnosis of ankylosis of the left temporomandibular joint. The onset of this condition had followed an operation for the removal of a brain tumor in January 1951. Shortly after the initial surgery, a skull plate had been inserted to cover the surgical defect brought about by the removal of the tumor from the left temporal region (Fig. 1).

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Reviewed in the Veterans Administration and published with the approval of the chief medical director. The statements and conclusions published by the author are the results of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

1. Kazanjian, V. H. Ankylosis of the temporomandibular joint. Surg., Gynec. & Obst. 67:333 Sept. 1938.

2. Brown, J. B., and others. Ankylosis of the coronoid process of the mandible (and associated scar limitation of jaw function). Plast. & Reconstruct. Surg. 1:277 Nov. 1946.

3. Martin, B. C. The role of the coronoid in ankylosis of the jaw. Oral Surg., Oral Med. & Oral Path. 2:984 Aug. 1949.

Fig. 1—Lateral view; metal plate in left temporal region

Extraoral examination revealed a completely fixed left temporomandibular joint with some pain and tenderness to palpation over this area; however, a slight movement of the right temporomandibular joint was perceptible. Despite this slight movement, moderate trismus appeared to be present.

The head and neck were otherwise normal except for a well-healed scar extending from 1 cm. anterior to the left auditory meatus directly upward 15 cm. to the left temporoparietal area. The patient reported that the scar resulted from the tumor operation.

Intraoral conditions appeared normal except for the absence of upper and lower teeth. Full upper and lower dentures had been constructed but had not been used.

Roentgenograms of the temporomandibular joints revealed no apparent bony changes. A provisional diagnosis of fibrosis of the left temporal muscle with resultant fibrous ankylosis was made. It was decided that resection of the coronoid process should be performed.

Routine preoperative physical examinations revealed no major contraindications to surgery. On September 13, 1951, the patient was prepared in the usual manner for general anesthesia. After intubation the mandible became relaxed and could be elevated to a certain point but could not be depressed. Since limited lateral jaw movements also could be demonstrated, it was felt that little or no intra-articular fibrosis of the left temporomandibular joint proper was present.

An incision approximately one inch long was made in the oral mucosa directly over the anterior margin of the left ramus of the mandible (Fig. 2). The soft tissue was dis-

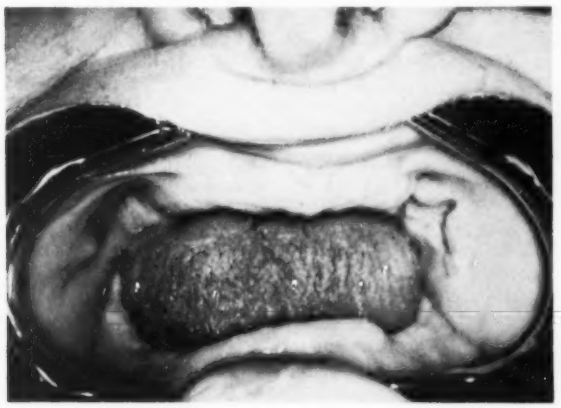
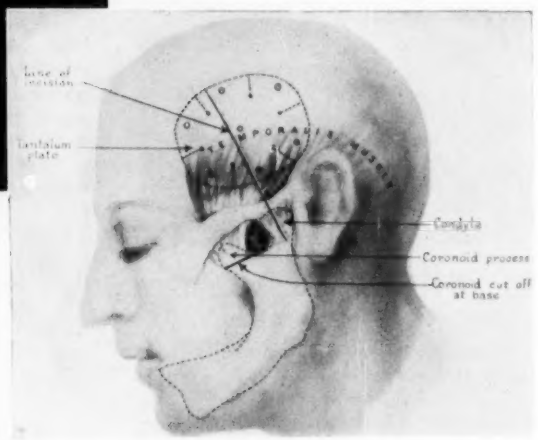


Fig. 2—Intraoral incision directly over anterior border of left ramus of mandible

Fig. 3—Left: Loss of left coronoid process



Right: Resection of left coronoid process

sected away and the periosteum elevated from the coronoid process. The attachment of the temporal muscle to the coronoid process was divided with scissors. The entire coronoid process was then removed with rongeur forceps (Fig. 3). Little bleeding was encountered. The wound in the mouth was closed with interrupted 00 chromic catgut. After this procedure, the mandible could be moved laterally and inferiorly without interference.

During the convalescent period frequent opening and closing jaw exercises were carried out by the patient, so that excellent function was maintained. Subsequently full upper and lower dentures were constructed to provide better occlusion.

SUMMARY—In a case of extra-articular ankylosis caused by fibrosis of the temporal muscle, a good measure of masticatory function was restored by surgical removal of the coronoid process. The result was considered satisfactory.

■ DICTIONARIES

Dictionaries are green and blooming pastures, wherein any fancier of curious and delightful things can meander contentedly for days.—*Ivor Brown, Word in Your Ear.*

Oral histoplasmosis: *report of case*

■ *Paul O. Snoke, M.D., and George J. Heid, M.D., Lancaster, Pa.*

An increasing number of case reports indicates that histoplasmosis is occurring more frequently. In approximately 30 per cent of all reported cases, involvement of the oral cavity, nose, throat or ears has been noted. Therefore it is important that all dentists and otolaryngologists should be sufficiently well versed in the clinicopathologic picture of the disease to recognize its characteristic features and to utilize indicated diagnostic studies.

EXAMINATION AND TREATMENT—On February 29, 1949 the patient came to the office with the complaint of multiple tumors of the mouth of approximately three months' duration. These tumors apparently were becoming larger and more numerous. Clinical examination revealed the mouth to be totally edentulous. Artificial dentures were present. There were multiple wartlike papillary tumors arising from the lower alveolus and several nodular tumors of the buccal mucosa near the corners of the mouth bilaterally. An additional number of smaller but similar lesions were present in the floor of the mouth and the lingual frenum. The cervical lymph nodes were not palpable.

Wassermann blood test and roentgenographic examination of the chest gave negative results, which ruled out syphilis and tuberculosis. Biopsies were taken from several representative areas and the remaining lesions were destroyed by electrodesiccation. Potassium iodide was prescribed by mouth and neoarsphenamine was given intravenously.

Subsequent microscopic examination by one of us (G.J.H.) showed the following: The largest of the three small fragments of tissue received for study had a diameter of 4 mm. One specimen was from the tongue, one from the right gingival sulcus and one from the left oral angle. Microscopically, one surface of each specimen submitted was covered by well-differentiated, nonkeratinizing, stratified squamous epithelium. The submucosal stroma of the tissue from the tongue was heavily infiltrated by large monocytes. Within the cytoplasm of practically all of the monocytes were many minute yeastlike bodies with prominent, round nuclei, surrounded by a clear zone and a distinct peripheral capsule. The cell structure of the yeastlike bodies was characteristic of *Histoplasma capsulatum*. Similar, but lesser, numbers of fungus-laden phagocytes were seen in the specimens from the left oral angle and the right gingival sulcus. The diagnosis was histoplasmosis.

A characteristic section was sent to the National Institutes of Health and the diagnosis of histoplasmosis was verified. Subsequent intradermal skin testing with undiluted histoplasmin was negative and blood submitted to the National Institutes of Health was found to be negative for agglutins.

Since the lesions had healed completely following electrodesiccation, no cultures could be obtained. Recovery at the time of writing was apparently complete, the only remaining evidence of disease being scarring of the oral mucosa.

DISCUSSION—For many years histoplasmosis has been confused with other diseases, primarily because of its relative rarity and the few opportunities for adequate study. In 1905 Darling,[1] while searching for visceral and cutaneous leishmaniasis, described an apparent case of histoplasmosis and subsequently reported two additional cases in 1908 and 1909. The findings in his cases were characterized by intracellular organisms or fungi that resembled, in certain characteristics, the organisms causing leishmaniasis. For about 25 years

1. Darling, S. T. A protozoon general infection producing pseudotubercles in the lungs and focal necrosis in the liver, spleen and lymph nodes. J.A.M.A. 46:1283 April 28, 1906.

only desultory work was done in respect to this disease, but in 1933 there was a revival of interest. Numerous cases have been reported since that time.

Several important characteristics of the disease have been noted. Although the mouth, ears, nose and throat are the most frequent primary site, generalized involvement may produce lesions in the lungs, bones or gastrointestinal tract. In a small group the initial lesion is in the skin. Calcified nodular lesions in the lungs resembling miliary tuberculosis have been demonstrated to be histoplasmosis. Despite a high mortality rate, not all cases are fatal. It is important to note that the organism can be grown on regular laboratory culture medium. It is an aerobic organism and grows in colonies like any other fungus.

Excellent papers describing substantiated cases of histoplasmosis have been reported by Ziegler,[2] Moore and Jorstad[3] and Reimann.[4] It must be concluded that this patient had a purely local manifestation with no evidence thus far of any generalized involvement. Ziegler[2] describes such local involvement as a subacute, localized infectious granuloma.

It must be remembered that the most striking single characteristic of this disease is that the organism grows intracellularly, particularly in reticuloendothelial cells. This distinguishes it from most other nontropical diseases seen in this part of the world.—*131 College Avenue.*

2. Ziegler, E. E. Histoplasmosis of Darling: review and case report with autopsy. Ann. Int. Med. 24:1073 June 1946.

3. Moore, M., and Jorstad, L. H. Histoplasmosis and its importance to otorhinolaryngologists. Review with report of case. Ann. Otol. Rhin. & Laryng. 53:779 Dec. 1943.

4. Reimann, H. A., and Price, A. H. Histoplasmosis in Pennsylvania. Confusion with parcoidosis and experimental therapy with bacillomycin. Penn. M. J. 52:367 Jan. 1949.

Complications associated with treatment of traumatic injuries of the oral cavity—aspiration of teeth: *report of case*

■ *Neville A. Booth, D.M.D., Boston*

The treatment of traumatic injuries involving the oral cavity is frequently beset with complications. In the case reported a complication developed, which fortunately terminated favorably without surgical intervention.

REPORT OF CASE—A 19 year old white girl was admitted to the hospital at 11:30 P.M., October 31, 1949, after an automobile accident. Preliminary examination disclosed a well-developed, well-nourished adolescent. The patient was unconscious, and preliminary clinical examination revealed a deep laceration of the chin, hematoma and laceration of the right eyelid, a fractured mandible, multiple lacerations of the mouth and oral bleeding. The lower left central and lateral incisor teeth were missing and not accounted for. The eyes showed abnormal pupillary size, with horizontal nystagmus to the right. The blood pressure was 80 systolic, 46 diastolic, with a

From the oral surgery department, Forsyth Dental Infirmary for Children.

Fig. 1—Chest three days after avulsion of tooth, showing shadow of increased density to the left of the midline

Fig. 2—Abdomen, showing two areas of increased density within the intestinal tract. The shadow seen in Figure 1 is not visible

weak pulse rate of 88 and shallow respirations of 36 per minute.

The diagnosis on admission was traumatic shock, laceration of the chin and right eyelid, compound fracture of the mandible, missing lower incisor teeth and possible skull fracture.

The patient remained semicomatose and was kept in restraint. Oral examination showed a compound mandibular fracture at the symphysis. Lower left central and lateral incisor teeth were missing, and the sockets appeared to contain no root fragments. No evidence of a skull fracture was found. The mandible was fractured below the left condyle and through the ramus on its distal portion.

TREATMENT—Treatment consisted of temporary fixation with elastic bandages and supportive treatment for improvement of the general condition. For the following two days the patient had periods of consciousness but remained restless. The general condition improved except for a complaint of pain in the left lower portion of the chest. On the fourth day she was rational but unable to orient herself and the events since the accident. The chest pain became severe. Roentgenograms showed a shadow of increased density in the midline of the chest, consistent with a portion of tooth (Fig. 1). Consultation was requested with a bronchoscopist, but prior to his arrival the patient experienced a severe coughing spell. Subsequent fluoroscopic examination showed the region of increased density to have moved to a point below the diaphragm and in the gastrointestinal tract. Roentgenograms of the chest confirmed this impression and the dense area was interpreted as being a bronchial foreign body that had been coughed up and swallowed.

The following day roentgenograms of the abdomen showed two shadows of increased density within the intestinal tract on the right side (Fig. 2). Her general condition was improved sufficiently to permit reduction and fixation of the mandibular fractures. The frac-

ture was reduced and occlusion maintained by application of intermaxillary elastic loops (Fig. 3).

On the tenth day after the accident roentgenograms of the chest revealed no evidence of pathosis. The mandible was in good alignment except for an outward displacement of the ramus near the left condyle (Fig. 4). She was discharged from the hospital to office care on the 27th day. Elastic traction was removed after four weeks of fixation. Clinical examination disclosed that adequate union was present at the sight of the symphysis fracture.

Three months after injury mandibular motion was adequate for all functional purposes. Roentgenographic study showed adequate reduction. No facial asymmetries were noted.

Fig. 3—Left side of mandible after application of intradental wires. Note evidence of fractures at the symphysis and in the ramus

Fig. 4—Posteroanterior view of the mandible. Note fracture and displacement of the left condyle

SUMMARY—The case of a 19 year old white girl who sustained facial injuries is reported because of the complications that occurred as a direct result of the trauma. Coincident to the mandibular fracture, two lower incisor teeth were avulsed and aspirated into the lungs. Return of the teeth occurred during a violent spell of coughing, and they were subsequently followed through the gastrointestinal tract by means of roentgenographic examinations. The presence of a fractured segment in the posterior portion of the mandibular ramus is also of unusual interest.

■ THE BENEFITS OF WORDS

Words, like deeds, may be constructive or destructive, elements of strength or expressions of decay. Those who learn to speak with charm, precision, vigor, and good diction, soon experience the benefits of well-used words.—*William G. Niederland, Man-Made Plague: A Primer on Neurosis.*

Neurilemmoma (schwannoma): *report of case*

■ *Conrad J. Spilka, D.D.S., Cleveland*

The neurilemmoma has been described by Stout[1] as a tumor that arises from the cells of the sheath of Schwann and constitutes an important variety of peripheral glioma. Masson[2] called the tumor a "schwannoma." Prior to this it was known as a neurinoma and later as a perineural fibroblastoma. Thoma[3] stated that the ensheathing collagen endoneurium is laid down under the direction of the Schwann cells, which multiply by longitudinal amitotic division of the nuclei, followed by cleavage of the cylinders, causing the typical palisade arrangement of the cells. These tumors are invariably benign and present a characteristic histologic make-up. They may appear anywhere in the body, and they exhibit no distinguishing gross features.

REPORT OF CASE—A white man, aged 39, first noticed the onset of pain in the right ear and the right side of the mandible in 1944. Dull pain was present constantly. Approximately six to eight times daily there was a sharp, severe, shooting pain, which lasted a few

Consultant in oral surgery, Crile and Brecksville Veterans Administration Hospitals.

1. Stout, A. P. Tumor of the ulnar nerve. Proc. New York Path. Soc. 18:1, 1918.
2. Masson, P. Experimental and spontaneous schwannomas. Am. J. Path. 8:367 July 1932.
3. Thoma, K. H. Oral pathology, ed. 2. St. Louis, C. V. Mosby Co., 1944.

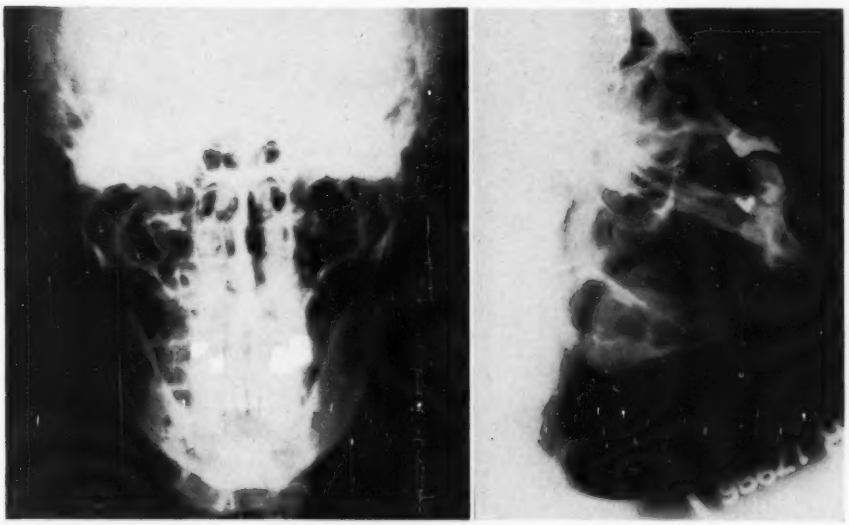


Fig. 1—Preoperative roentgenograms showing multilocular appearance and extent of bone destruction

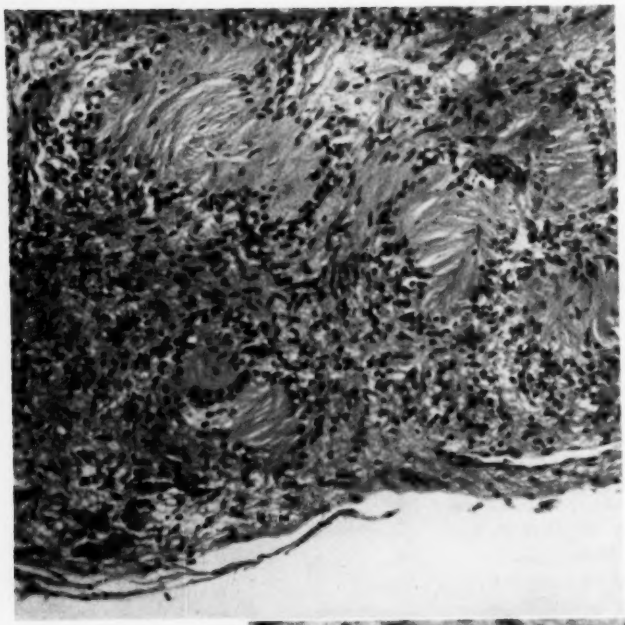
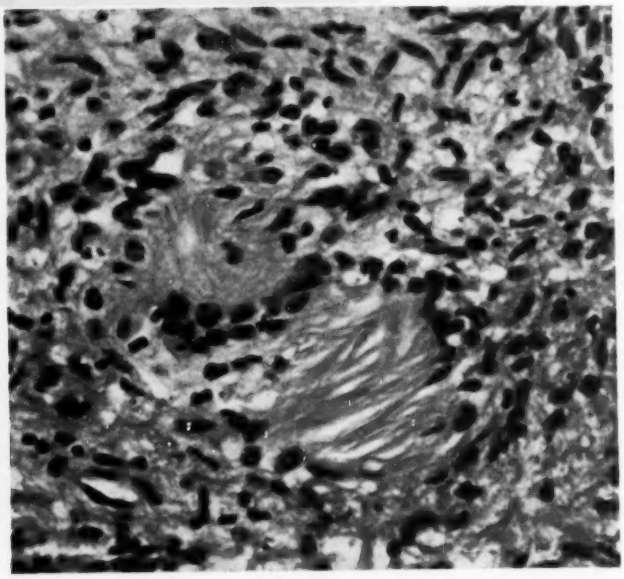


Fig. 2—Left: Interlacing network of wavy flowing streams of cells in which the nuclei are in palisade arrangement (high power, ×135)

Right: "Verocay bodies" (low power, ×380)



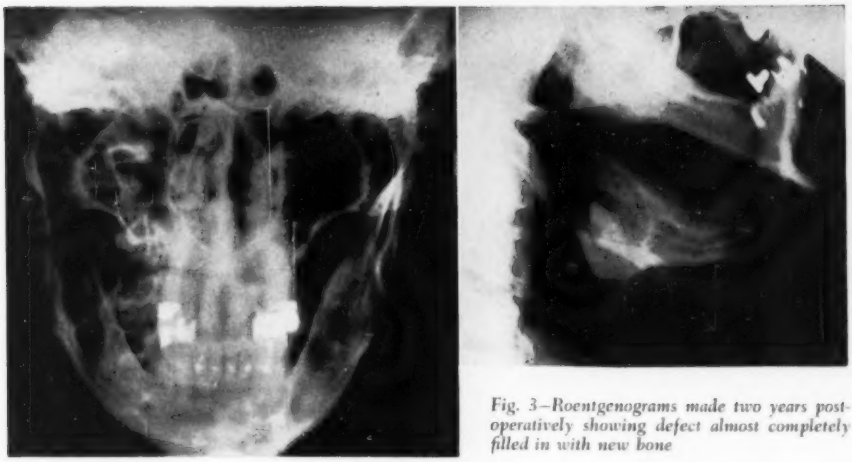


Fig. 3—Roentgenograms made two years post-operatively showing defect almost completely filled in with new bone

seconds to several minutes. The pain radiated along the right side of the mandible up to the right ear and right temporal region. At no time was there any oral or facial swelling.

The patient was well-developed and well-nourished, with no complaint other than the mandibular pain. There was some tenderness under the angle of the right side of the mandible but no evidence of swelling or tenderness in the cervical nodes. The heart and lungs showed no remarkable symptoms. The mucous membrane was normal in tone and color. There were no intraoral abnormalities.

On admission, December 8, 1948, the temperature was normal, the pulse rate 78 and the respiratory rate 28. The leukocyte count was 9,000, hemoglobin 14.5 Gm. per 100 cubic centimeters and erythrocyte count 4,780,000. The differential count showed 50 per cent neutrophils and 35 per cent lymphocytes. The specific gravity of the urine was 1.020, and the reaction was acid. Results of tests for sugar and albumin were negative.

The roentgenologist reported a large cystic rarefied region in the body and ramus of the right side of the mandible, extending from the second molar region to the sigmoid notch. The cystic region measured approximately 3 by 4 cm. (Fig. 1).

Under local anesthesia, an incision was made in the retromolar region over the crest of the alveolar ridge from the first molar region posteriorly up the ascending ramus. A second incision was made at the beginning of the first incision and extended inferiorly into the mucobuccal fold. The mucoperiosteum was elevated and retracted. With a mallet and osteotome, a window was made over the third molar region and extended distally up the ascending ramus to the coronoid process. The tumor mass was found to be firmly attached to the inferior alveolar nerve. Because of this firm attachment, the tumor was removed in several segments. Examination of the bony cavity revealed partial destruction of the lateral and medial walls of the ramus. The wound was packed with lubricated iodoform gauze. The tissues were approximated and sutured with 4-0 silk, with an adequate opening left for dressing changes.

Grossly, the specimen consisted of several irregular fragments of red and yellowish white tissue. The larger three had smooth, lobulated surfaces, while the smaller had well-defined, elongated, central areas. When sectioned, the

two larger pieces of tissue had slightly irregular golden yellow centers with opaque, grayish white peripheral zones. Microscopically, the sections showed interlacing whorls of elongated, poorly delimited cells with numerous "Verocay bodies." The nuclei of the cells were oval to spindle-shaped and vesicular (Fig. 2). The diagnosis was neurilemmoma (schwannoma).

There were no postoperative complications other than parasthesia of the right lip, which resulted from trauma to the inferior alveolar nerve. The dressings were changed at 48 hour intervals. The patient was discharged from the hospital December 31, 1948, and subsequent dressings were continued for three months. The patient was kept under periodic observation. Repeated roentgenographic examination showed the defect to be filling in with bone. On June 28, 1950, roentgenograms revealed the defect to be almost completely filled in with new bone (Fig. 3). The patient reported that the parasthesia of the lip had completely disappeared.

SUMMARY—This case is of interest because of the long history of pain. Neurilemmomas are rare and may grow asymptomatically for many years. Roentgenographically, they may be mistaken for adamantinoma or multilocular cysts. Examination of the gross tumor mass ruled out the possibility of a cyst. Only after microscopic examination of the tumor was a definite diagnosis possible.—*2012 West Twenty-fifth Street.*

Congenital dislocation of mandibular joint: *report of case*

■ *R. P. Gingrass, D.D.S., M.D., Milwaukee, Wis.*

The patient, a 47 year old woman, was first seen on November 18, 1949. The complaint was pain in the left side of the face. The patient stated that for the past year she had pain in the left ear and orbital regions. The pain was intensified during mastication, and there was difficulty in opening the mouth after masticating. Grating noises were present on the left side.

EXAMINATION—The face was not symmetrical, the left side being shorter than the right (Fig. 1, left). This was caused by arrested development. There was a hollowed-out depressed area in front of the left ear. It seemed as though the entire ramus on that side was in a forward position. The condyle could not be readily palpated. When the mouth opened, there was some deviation to the left. The occlusion of the remaining teeth was almost normal (Fig. 1, right). Roentgenograms were made of the mandibular joints and the mandible (Fig. 2). The diagnosis was congenital dislocation and traumatic arthritis of left mandibular joint.

TREATMENT—With thiopental sodium anesthesia a condylectomy was performed through a preauricular incision and exposure. The capsule and meniscus were fairly well developed. The condyle was small and flat and covered with thin hyaline cartilage. No glenoid fossa was present. The patient made an uneventful

From the department of surgery, Marquette University, Milwaukee, Wis.

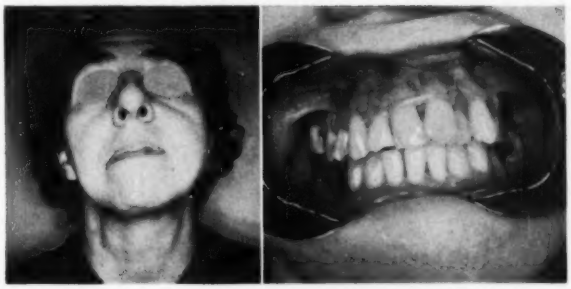


Fig. 1.—Left: Facial appearance of patient. Right: Occlusion of teeth

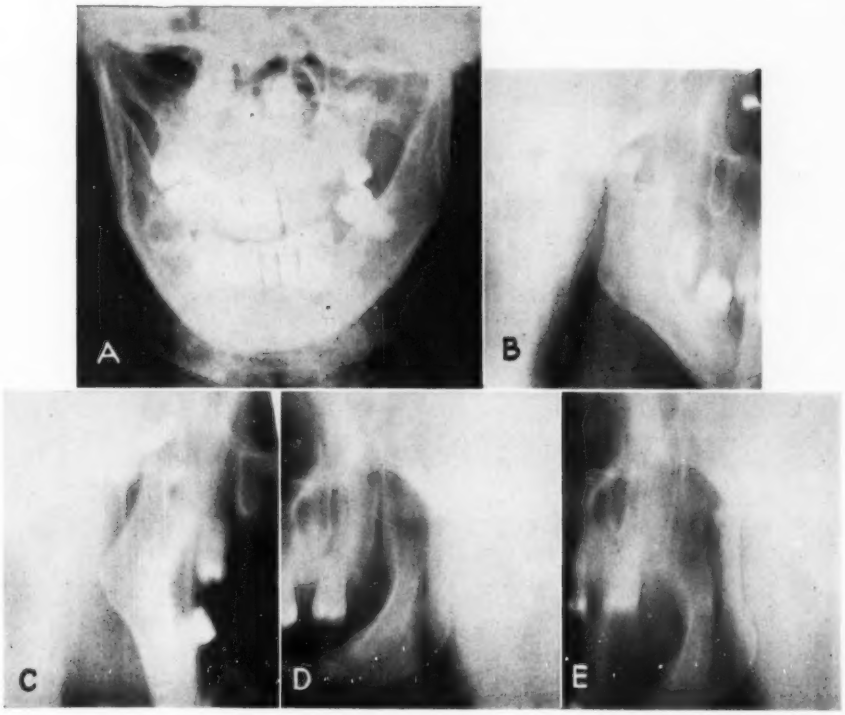


Fig. 2.—A: Left side of the body and ramus are shortened. B: Left side, mouth closed, showing anterior dislocation of condyle. The glenoid fossa is shallow and indistinct. C: Left side, mouth open, showing the condyle in a still more forward position. D: Right side, mouth closed, normal joint. E: Right side, mouth open, showing normal position of condyle resting on eminentia

recovery and was relieved of her pain. There was some posterior and anterior displacement of the mandible on the left side similar to that occurring after arthroplasty. This was relieved by grinding of the teeth.

COMMENT—This condition appears to have been present at birth and was due to abnormal development. It does not appear to have been caused by trauma; however, this factor cannot be entirely disregarded.

Developmental anomaly of maxillary dentition following trauma: *report of case*

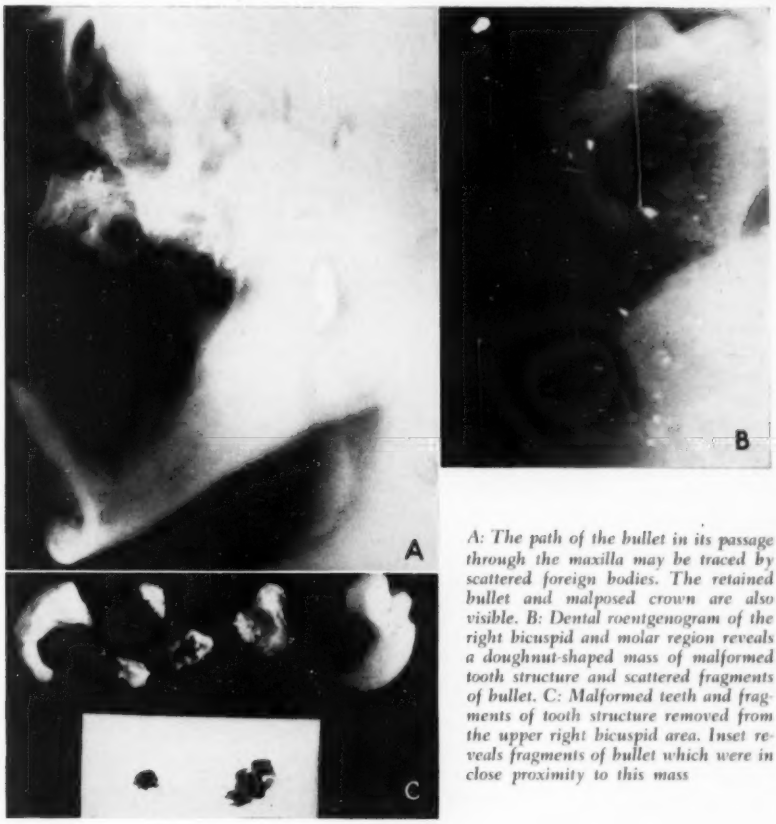
■ *W. B. Irby, D.D.S., M.S., and K. W. Hughes, D.D.S., Fort Monmouth, N. J.*

A well-developed white man, aged 19, presented himself August 10, 1949, complaining of a faulty upper denture. The patient had been accidentally injured at five years of age by a .22 caliber rifle bullet. A slight scar on the left ala nasi marked the point of entrance of the bullet. To the best of the patient's knowledge, the bullet had never been removed. Deciduous teeth were reported to have been normal; however, the right permanent maxillary teeth posterior to the cuspid failed to erupt. Approximately one year prior to the present examination, the remaining upper teeth were extracted because of extensive caries.

EXAMINATION—Visual examination of the mouth revealed an edentulous maxilla and a partially edentulous mandible, with the remaining teeth in good repair. Roentgenographic examination revealed small foreign bodies scattered throughout the right maxilla, outlining the path of a larger foreign body visible posterior to the right maxilla in soft tissue. This foreign body was believed to be the .22 caliber bullet (illustration, A). In the right bicuspid and first molar region a mass was found which appeared to be similar to a calcified composite odontoma (illustration, A and B).

OPERATION—On August 20, 1949, the patient was hospitalized and was given 1½ grains (0.09 Gm.) of pentobarbital and 1/150 grain (0.40 mg.) of atropine sulfate. Under local anesthesia, a flap was reflected to expose the alveolar bone in the right bicuspid and molar region. On removal of a thin buccal plate of bone, the composite mass was exposed and removed. The contents of the mass consisted of numerous oddly shaped masses of tooth structure, several small fragments of lead and two anomalous teeth (illustration, C). The bony cavity was then filled with fibrin foam and closed with black silk sutures. Recovery was uneventful. No attempt was made to remove the crown of the molar tooth or the bullet.

COMMENT—This case is thought to be of interest because of the unusual etiologic factors. Authorities generally agree that trauma to tooth germs may produce tooth anomalies. The degree and type of anomaly produced depends on the extent of injury and the development within the tooth follicle at the time of



A: The path of the bullet in its passage through the maxilla may be traced by scattered foreign bodies. The retained bullet and malposed crown are also visible. B: Dental roentgenogram of the right bicuspid and molar region reveals a doughnut-shaped mass of malformed tooth structure and scattered fragments of bullet. C: Malformed teeth and fragments of tooth structure removed from the upper right bicuspid area. Inset reveals fragments of bullet which were in close proximity to this mass

injury. Early fragmentation of enamel organ epithelium may result in isolated groups of cells, which in turn will produce anomalous teeth. Also it is known that detachment of the enamel organ and cap from already formed dentin will not completely halt dentin formation. Therefore, although the mass described is similar in appearance to a calcified composite odontoma, it is not believed to be a true odontoma. Rather, it appears to be an anomaly caused by laceration and fragmentation of developing tooth germs, at a fairly early stage of development, by a high velocity projectile. —*Station Hospital.*

Mandibular tumor metastasized from a hypernephroma: *report of case*

■ *Everett E. Stewart,* D.D.S., and Karl W. Bruce,† D.D.S., Rochester, Minn.*

Although metastasis of hypernephroma to the skeleton is by no means uncommon, metastasis to the mandible is exceedingly rare. Only a few cases have been reported.

Kozoll and Kirshbaum,[1] in a review of 44 cases of malignant hypernephroma, list the mandible as the site of a metastatic lesion in one instance only. Vogt[2] reported a case of hypernephroma from which there was a metastatic growth simulating a dental cyst of the lower jaw. Albrecht[3] as early as 1905 recorded a case of metastasis from a hypernephroma of the left kidney to the left side of the mandible. The largest number of cases of metastasis from a hypernephroma to the jaws was reported by Berg[4] in 1936. Of four cases, the mandible was involved in two, the maxilla in one and the maxillary gingiva in one. Sherman and Pearson[5] reported two cases in which renal cancer had metastasized to the mandible and one case in which it had metastasized to the maxilla. They do not state specifically the type of renal cancer.

Areas in the oral cavity other than the mandible likewise have been reported as sites of metastatic lesions from hypernephroma. Lehmann[6] in his paper on metastasis from hypernephroma to the skeletal system reported one instance of involvement of the maxilla. Le Count[7] in 1901 reported a case in the "superior maxilla."

In the case reported by Branch and Norton,[8] metastasis had been present for 18 months. The lesions were located in the soft tissue on the lingual surface of the mandible, but they did not involve the bone directly. In a similar case recorded by Stein,[9] the secondary tumor was located in the labial gingiva of the maxilla.

Salman and Darlington[10] reported a case of hypernephroma with ultimate involvement of the hard palate. Schrag and Jordan[11] reported an unusual case of metastasis from a primary hypernephroma to the tongue. In a case described by Bernier and Tiecke[12] metastasis from a hypernephroma to the lower lip occurred nine months after removal of the primary lesion from the left kidney.

The case reported in this article is one of the more uncommon metastatic malignant tumors found in the jaws.

CASE HISTORY—On September 1, 1951, a 70 year old white man, an inmate of a mental hospital, was examined because of a painful swelling in the lower left side of the jaw. It was estimated that the swelling had been present for three or four days.

*Mayo Foundation, University of Minnesota.

†Section of dentistry, Mayo Clinic.

1. Kozoll, D. D., and Kirshbaum, J. D. Relationship of benign and malignant hypernephroid tumors of kidney; clinical and pathological study of 77 cases in 12,885 necropsies. J. Urol. 44:435 Oct. 1940.

2. Vogt, L. G. Hypernephrommetastase unter dem Bilde einer Wurzelzyste im Unterkiefer. Röntgenpraxis 11:99 Feb. 1939.

3. Albrecht, Paul. Beiträge zur Klinik und pathologischen Anatomie der malignen Hypernephrome. Deutsch. Gesellsch. f. Chir. Verhandl. 34:620, 1905.

4. Berg, A. Metastatische Kiefertumoren. Wien. klin. Wchnschr. 49:970 July 31, 1936.

5. Sherman, R. S., and Pearson, T. A. The roentgenographic appearance of renal cancer metastasis in bone. Cancer 1:276 July 1948.

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7. Le Count, E. R. Hypernephroma of the kidney with a metastatic growth in the superior maxilla. Tr. Chicago Path. Soc. 6:373 Dec. 11, 1905.

8. Branch C. F., and Norton, R. H. Metastatic hypernephroma of the jaw. New England J. Med. 198:559 May 3, 1928.

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10. Salman, Irving, and Darlington, C. G. Rare (unusual) malignant tumors of the jaws. Am. J. Orthodont. & Oral Surg. 30:725 De., 1944.

11. Schrag, A. R., and Jordan, F. B. Unusual metastasis from a primary hypernephroma. Canad. M.A.J. 53:168 Aug. 1945.

12. Bernier, J. L., and Tiecke, R. W. Three rare oral tumors. J. Oral Surg. 9:161 April 1951.

The patient was wearing complete upper and lower dentures. A swelling the size of a hazelnut was present in the left molar region, centered laterally and inferiorly to the body of the mandible. There was an ulcerative wound 1.5 cm. long in the mucobuccal fold into which fit the buccal flange of the lower denture. Palpation did not reveal any cervical nodes. The impression was that the lesion was an acute infection caused by irritation from the buccal flange of the lower denture. The swollen tissue was incised with the intention of establishing drainage, which was, however, unnecessary because pus was not present. Antibiotic therapy was started (600,000 units of penicillin G procaine daily), and moist heat was applied to the left side of the face. Roentgenograms were not made at this time. The patient's dentures were withheld so that he would not use them until the swelling subsided.

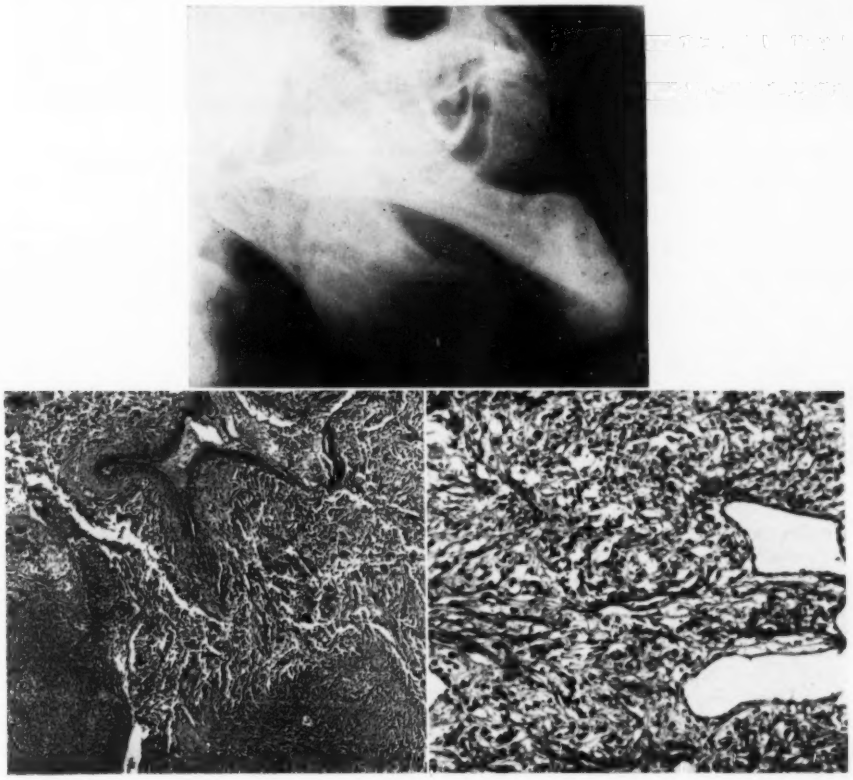

Fig. 1—Above: Lateral view of left side of mandible, showing area of decreased density in molar region. Note pathologic fracture in this area. Below left: Low-power photomicrogram (×30) of tumor in left side of mandible; tumor metastasized from hypernephroma. Observe neoplastic cells in vessel with regions of necrosis. Below right: High-power photomicrogram (×100) of tumor metastasized from hypernephroma. Note solid sheets of large cells with abundant pale, foamy cytoplasm

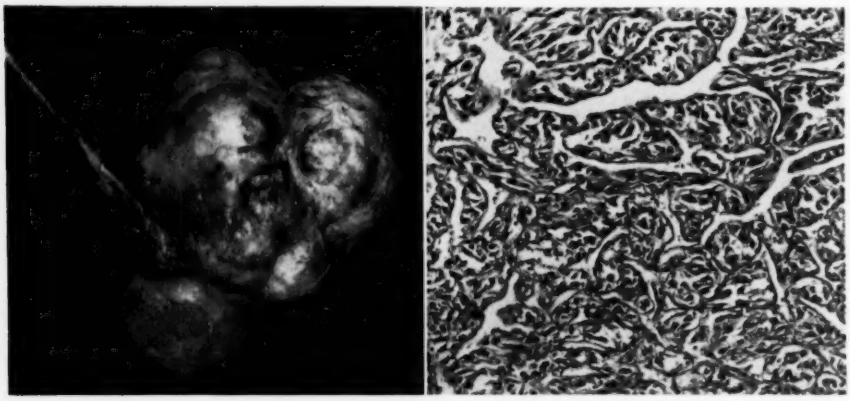

Fig. 2—Left: Gross specimen of left kidney showing primary hypernephroma. Right: High-power photomicrogram (×100) of primary hypernephroma of left kidney. Note similarity of cell pattern to that observed in metastatic tumor of left mandible

On September 11, 1951, the wound was completely healed; but the swelling persisted in spite of the fact that penicillin therapy had been continued during the entire interval. Roentgenograms of the jaws showed evidence of a radiolucent area of destruction of the mandible in the lower left molar region; this destruction was suggestive of malignant change. In addition, a pathologic fracture of the mandible at the site of the lesion was detected (Fig. 1, above).

The following day a specimen of tissue from the site of the swelling was excised for microscopic study. After removal of the specimen, profuse bleeding occurred which was controlled with considerable difficulty. The pathologist reported the presence of a tumor metastasized from a hypenephroma (Fig. 1, below).

On November 27, 1951, about 11 weeks after the establishment of the diagnosis of malignant tumor in the mandible, the patient died. In the necropsy it was found that the patient had a papillary adenocarcinoma (hypernephroma) of the left kidney with metastasis to the lungs, sternum, ribs, vertebrae, dura and mandible. The left kidney weighed 405 Gm. as compared to 150 Gm. for the normal right kidney. A mass 10 cm. in diameter occupied two thirds of the left kidney (Fig. 2, left). It was yellowish brown and contained areas of necrosis and calcification.

Microscopic examination of the tumor of the left kidney showed that scattered among the necrotic masses were solid sheets of large cells with abundant pale, foamy cytoplasm (Fig. 2, right). The cells had irregular hyperchromatic nuclei and were separated by trabeculae of connective tissue and vessels. The lesions in the lungs, sternum, ribs, vertebrae, dura and jaw contained solid sheets of cells with the same characteristics.

COMMENT—Lichtenstein[13] made the surprising statement that metastatic carcinoma is by far the most common type of malignant bone tumor and should be considered carefully in making a differential diagnosis. Only a limited number of such foci manifest themselves clinically through the development of severe pain, a palpable tumor, pathologic fracture or neurologic manifestations. Many more give rise

13. Lichtenstein, Louis. Bone tumors. St. Louis, C V Mosby Co., 1952.

only to a vague awareness of their presence, or they are entirely imperceptible.

Coley[14] stated that, theoretically, all types of bone tumors, both benign and malignant, may occur in the jaws. When a tumor is encountered in the maxilla or mandible, the possibility that it may be a metastatic lesion must be borne in mind, although these bones are only infrequently involved.

Stones[15] expressed the opinion that the reason that the jaws are rarely affected is that they contain less red marrow and are less vascular than some of the other bones of the skeleton. The mode of spread is almost always hematogenous. Before hematogenous metastasis of carcinoma can occur, the tumor must have invaded the adjoining veins or one of the large lymphatic vessels.

Hypernephroma shows a special tendency toward vascular involvement.[16] Invasion of the renal vein and even of the inferior vena cava occurs, and widespread metastasis is the result. Some pathologists are of the opinion that a metastatic tumor from a hypernephroma has a predilection for the bones.[17] A lesion of the bone may be the first indication of the tumor. It is nearly always osteolytic.

A mandibular tumor metastasized from a hypernephroma is usually a central tumor.[18] Because of its location, pressure may be exerted on the mandibular nerve so that one of the earliest symptoms may be pain. With increased destruction of bone by the tumor, a pathologic fracture of the jaw, such as that reported in this case, may occur.

14. Coley, B. L. Neoplasms of bone and related conditions; their etiology, pathogenesis, diagnosis and treatment. New York, Paul B. Hoeber, Inc., 1949.

15. Stones, H. H. Oral and dental diseases; aetiology, histopathology, clinical features and treatment; a textbook for dental students and a reference book for dental and medical practitioners, ed. 2. Edinburgh, E. & S. Livingstone, 1951.

16. McDonald, J. R., and Priestley, J. T. Malignant tumors of the kidney; surgical and prognostic significance of tumor thrombosis of the renal vein. Surg., Gynec. & Obst. 77:295 Sept. 1943.

17. Geschickter, C. F., and Copeland, M. M. Tumors of bone, ed. 3. Philadelphia, J. B. Lippincott Co., 1949.

18. Sarnat, Bernard G., and Schour, Isaac. Oral and facial cancer. Chicago, Year Book Publishers, Inc., 1950.

■ The Dilemma of Analysis and Synthesis

We have inherited from our forefathers the keen longing for unified, all-embracing knowledge. The very name given to the highest institutions of learning reminds us, that from antiquity and throughout many centuries the universal aspect has been the only one to be given full credit. But the spread, both in width and depth, of the multifarious branches of knowledge during the last hundred odd years has confronted us with a queer dilemma. We feel clearly that we are only now beginning to acquire reliable material for welding together the sum total of all that is known into a whole; but, on the other hand, it has become next to impossible for a single mind fully to command more than a small specialized portion of it.

I can see no other escape from this dilemma (lest our true aim be lost forever) than that some of us should venture to embark on a synthesis of facts and theories, albeit with second-hand and incomplete knowledge of some of them—and at the risk of making fools of ourselves.—*Schrödinger (1945).*

Amputation neuroma: *report of case*

■ *Harold G. Green, D.D.S.**

An unusual case of amputation neuroma was referred to the dental service of the U. S. Naval Hospital, Jacksonville, Fla., March 1, 1951.

The patient reported that a tumor had been removed two years previously because the growth was sore. The pathologist reported it as a "nerve tumor." Two months prior to March 1, 1951 the region became tender and the patient applied for examination.

Examination revealed a well nourished, well developed white woman, 27 years of age, in no apparent distress. Her pulse was 88, temperature 99°, respiration 18 and blood pressure 100/58. No abnormalities of the head and neck were noted and no palpable lymph nodes or enlargement of glands. The mouth was clean and contained a full complement of teeth in good repair. No abnormalities were noted other than a small nodule, 1 by 1 cm., located in the lower right buccolabial vestibule, at approximately the level of the mental foramen. The nodule was freely movable and of firm consistency. Roentgenograms of the region revealed no demonstrable bone pathology. Laboratory findings were within normal limits. The impression was that it was a soft tissue tumor. Recommended treatment was excision biopsy.

TREATMENT—The patient was premedicated with 0.1 Gm. of pentobarbital sodium two hours before the operation and with 50 mg. of meperidine one hour before. The anesthetic used was 2 per cent procaine hydrochloride with epinephrine 1:60,000 for mandibular block and local infiltration. An elliptical incision was made over the buccal aspect of the alveolar ridge from the lower right first molar to the lower right lateral incisor. The mucobuccal flap was retracted toward the cheek and a small tumor was dissected from the overlying soft tissue. Its lower end was attached to the mental nerve emerging from the foramen. Approximately 1.0 cm. of bone was removed over the mandibular canal. The nerve was evulsed another 0.5 cm. and sectioned. There was no appreciable bleeding and the tissue was closed with catgut no. 00. A small pressure bandage was applied. The postoperative course was uneventful. The patient complained of numbness of the right side of the lower lip.

HISTOPATHOLOGICAL REPORT—Gross examination revealed a specimen consisting of a segment of nerve containing a smooth, rounded, bluish-gray firm mass 8 mm. in diameter and 3 mm. in thickness. The microscopic examination showed the specimen to consist of a myelinated nerve trunk which contained a localized area of enlargement due to ingrowths of fibrous tissue, with separation and distortion of the nerve bundles. This process was circumscribed and did not involve the distal nerve trunk. The diagnosis was neuroma.

COMMENT—A follow-up examination on May 15, 1951 revealed that the patient had remained asymptomatic and the numbness of the lip was gradually disappearing. A small amount of scar tissue was palpable over the operative site, otherwise the region was normal. Roentgenographic examination was negative. There were no palpable lymph nodes in the neck. The patient when last seen stated she was comfortable and had experienced no difficulty.

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

*Commander, Dental Corps, U.S. Navy, Naval Hospital in the U.S.S. Consolation (AH-15), c/o Fleet Post Office, San Francisco, Calif.

Antibiotics in oral surgery

DEVELOPMENT of several broad-spectrum antibiotics has had a profound effect on the field of oral surgery. Whereas much of the oral surgeon's professional time previously was occupied by patients who were seriously ill with pyogenic infections, today the surgeon engaged in training hospital residents in the management of neck and jaw infections finds it rather difficult to obtain proper and adequate cases of this type for teaching purposes. Acute osteomyelitis is but rarely seen while Ludwig's angina, deep abscesses and erysipelas also are infrequently encountered. In spite of this comparative decrease, anybody using antibiotics in his daily practice should be continually on the alert for changing concepts of treatment and for the addition of new and useful drugs. The need for increasing dosages of penicillin or the combining of two antibiotics such as streptomycin and penicillin in the treatment of enterococcal infections are simple examples of the gradual developments in the management of infections. Similarly, it behooves the dentist as well as the oral surgeon to understand clearly the clinical picture of allergic response to the antibiotics and to be schooled in the management of this complication. The ability to substitute another antibiotic which will provide adequate, safe coverage when a patient gives a history of penicillin reaction is an obvious obligation.

Many of us have been guilty of the indiscriminate use of low-dosage penicillin troches or lozenges frequently producing allergic responses or causing the infections to become resistant. Instead we should either treat heavily or not at all. Infections that fail to respond to the usual three or four hundred thousand units per day frequently will clear up dramatically with the use of one or two million units per day or perhaps through the use of a combination of penicillin and streptomycin. Conversely, relatively low dosages of oral penicillin, under certain circumstances, will produce excellent results. The chief value of low dosages of oral penicillin, however, usually is conceded to be the containing of an already obviously mild infection. Rapidly developing virulent infections de-

mand treatment with large dosages at the earliest possible opportunity. The testing of bacterial strains for their sensitivity to the various antibiotics is a well-established procedure which should always be employed in resistant or serious infections when the organism is available for culture.

It is the professional responsibility of everyone concerned with oral health to keep abreast of all developments in the field of antibiotics, and it is hoped that every oral surgeon will take pride in his intimate knowledge of this extremely important subject.—*Fred A. Henny.*

■ Order of Removal in Multiple Extractions

Q.—In cases of multiple extractions, is there any order of removal which is preferable?

A.—The order will be dictated by considerations of root formation, tooth position and supporting bone. Generally the cuspids should be removed first while the adjacent teeth are supporting the alveolar process at the corners of the arch. When adjacent teeth are removed first, there is likelihood of fracture of a large segment of process when the cuspid is removed.

■ Lesion of the Palate

Q.—Six weeks ago I performed a biopsy on an ulcerative lesion of the palate. The pathologist's report showed no malignancy. The area has not healed, however, and has increased slightly. What do you suggest?

A.—All sources of diagnostic information should be reviewed in this case, but the most significant recommendation is to repeat the biopsy without delay. The biopsy should be made as representative as possible of the pathologic change. A single biopsy report gives no positive assurance that neoplasm has been ruled out.

■ Examination for Antral Opening

Q.—After removing upper posterior teeth, what is the safest method to determine if the alveolus communicates with the maxillary sinus?

A.—The apical contour of the alveolus can be checked with a long fine gauge local anesthetic needle. If the perforation is small and there is no indication of sinus infection, a normal clot may seal the opening. Care always must be taken not to establish an oroantral fistula. Promotion of normal nasal sinus drainage and precautions against intranasal pressure may be adequate. Larger openings and an infected sinus complicate the problem.

■ Treatment of Mucocele of the Lip

Q.—Should a mucocele of the lip be biopsied by sectioning into it?

A.—No. These retention cysts of accessory salivary glands in the lip should be excised as completely and carefully as possible. Sectioning or incomplete removal will mean recurrence in a short time. Excisional biopsy is the treatment of choice.

■ Reactions to Penicillin Troches

Q.—Is it possible to get allergic reactions to the topical use of penicillin for mouth infections?

A.—This use of antibiotics appears to be one of the chief offenders in producing sensitization. Significant rashes, swelling and exfoliative dermatitis have been reported to result from this form of penicillin therapy. If topical administration is used, one of the antibiotics which is limited to topical use, such as bacitracin, appears to be indicated.

This section, devoted to queries and comments from readers on topics of current interest to oral surgeons and general dental practitioners, is edited by James R. Hayward, University Hospital, Ann Arbor, to whom readers are invited to send their communications. The answers, prepared by competent consultants, do not necessarily represent the opinions of any official scientific organization. Your participation in this section is invited.

The Editor

■ Maxillary Cyst

Q.—Six months ago one of my patients had a large cyst in the maxilla which was treated by Partsch operation. In the first few months the cystic cavity reduced to half its original size. The remaining pocket defect has remained about the same size for the past two months. Is any further treatment indicated?

A.—These residual defects may persist for long periods of time and become annoying to the patient. If good bone regeneration has reduced the size of the cyst, the remaining lining may be enucleated with closure of the mucoperiosteal margins at the surface. In many instances this may shorten the healing time.

■ Submerged Deciduous Molars

Q.—In a 30 year old patient, the lower second bicuspids are congenitally absent and the retained deciduous molars are submerged and completely enclosed since the first molars have drifted forward. Roentgenograms of the roots of these teeth are not clear and the surrounding bone is dense. How should this problem be handled so that fixed bridges can be placed?

A.—Since these deciduous teeth are ankylosed to bone and the roots are partially replaced by bone, these teeth must be cut away in a block. After good exposure by adequate flap reflection, bone drills can be used to section the tooth and cut the remaining root structure from the underlying bone. Since space is limited, great care must be taken not to damage the adjacent teeth.

■ Tumor of Mandible

Q.—A 14 year old boy was brought to me for diagnosis of a chronic swelling of the jaw. Roentgenograms revealed an area of destruction 4 cm. in diameter in the angle region of the mandible. Biopsy of this bone indicated ossifying fibroma. What treatment is indicated?

A.—Since this variety of tumor is benign, a conservative method of removal is best. Complete local excision should be adequate. It is important that the oral surgeon who removes the lesion be familiar with the original findings and biopsy. All of the material removed should be reviewed by the pathologist. It is unlikely that disturbance in growth centers will be important at this age.

■ Oral Manifestations of Occupational Origin: An Annotated Bibliography. By F. J. Walters; J. W. Fridl; Raymond L. Nelson, and Jon W. Trost. 40 pages. Washington, D. C., Federal Security Agency, Public Health Service, Division of Occupational Health, 1953.

Articles reporting oral conditions associated with occupation appear in a broad variety of publications. The purpose of this compilation is to bring together information regarding such articles so that they may be more readily available to dentists and other interested persons or groups.

This is a comprehensive handbook of 40 pages which lists all of the various agents that might be responsible for oral manifestations of an occupational nature.

The articles are arranged in groups according to category of exposure; namely, acids, bacteria, dusts, gases, inorganic substances, metals, organic compounds and physical factors. Articles referring to several types of exposure are classified under "General Review." Occupational cancer has been placed in a separate category. The types of exposure within each category are listed alphabetically. In those instances where a number of articles are presented which deal with a specific exposure, the listing is in reverse chronological order with the more recent articles appearing first. Numbers following listed headings refer to item numbers, which run consecutively throughout the publication. An author index follows the abstracts.

Free copies are available on request from the Division of Occupational Health, United States Public Health Service, Federal Security Building, Washington 25, D. C.—*Reed O. Dingman.*

■ 1952 Year Book of Dentistry. By Stanley D. Tylman, Donald A. Keys, John W. Knutson, Harold J. Noyes, Hamilton B. G. Robinson, Carl W. Waldron. 519 pages with 315 illustrations. Index. Price $5.75. Chicago, The Year Book Publishers, Inc., 1953.

Articles from the dental periodical literature from September 1951 through August 1952 have been selected and digested by an editorial board of six specialists in the branches of dentistry covered in this volume. Material is grouped as follows: prosthetic dentistry; operative dentistry; public health; orthodontics; oral pathology and oral medicine; oral surgery.

Selections range in length from a few paragraphs to several pages, but even the shorter digests appear comprehensive enough to be of real informative value. Short comments by the editor of the section follow each entry.

Periodical dental publications of the United States furnish the bulk of material included, although some foreign journals are listed, as well as publications from allied fields. It is apparent that magazines specializing in the particular subject under discussion have been used as source material for that particular section of the *Year Book*. For example, in the public health section dealing with fluoridation one finds selections from such magazines as: *American Journal of Public Health, New England Journal of Medicine, Journal of Dental Research, Science* and *The Journal of the American Dental Association*. Excerpts for the orthodontic section are drawn from such publications as: *Angle Orthodontist; American Journal of Orthodontics* and *The Dental Record*, a British journal which usually carries considerable orthodontic material.

The same size and format of the preceding

annual volumes have been maintained. Paper is of a quality to permit constant use of the book for reference, and the many illustrations are clear. Type size is easy on the eyes. There is an index of titles and an author index.

Like other volumes of the dental Year Book series, this issue is a convenient guide to the extensive dental literature. It provides an over-all picture of current dental writing in an easy-to-take capsule form.—*Martha Ann Mann.*

■ A MANUAL OF ORAL SURGERY. By W. Harry Archer. 626 pages with 1,036 illustrations. Price $15. Philadelphia, W. B. Saunders Co., 1952.

The subtitle, "A Step-by-Step Atlas of Operative Technics," is a good description of this voluminous text which begins with 154 pages and 257 illustrations on the extraction of teeth. This is an excellent presentation and could well serve as the principal guide to the beginning student or to the practitioner in need of refining his technical procedures in tooth extraction. Especially well done are the instructions on instrumentation, the chair and finger positions and the detailed illustrations of operative procedures in difficult extractions including the removal of broken roots and impacted teeth.

While the book is primarily the work of the author, he has delegated to competent colleagues the chapters on oral malignancies, cleft palate and lip, roentgen anatomy, and some other topics. A chapter on the complications associated with oral surgery and another on oral surgery in the hospital are distinct additions to the value of the text. A chapter on oral infections and one on fractures are profusely illustrated and the treatment of cysts is well covered.

The author has produced a book which should be of very real and practical value. It can be especially recommended to the dentist of limited experience who requires an effective guide to increasing his competence in managing the many problems in minor oral surgery.—*Charles W. Freeman.*

■ NEW AND NONOFFICIAL REMEDIES. Issued under the direction and supervision of the Council on Pharmacy and Chemistry of the American Medical Association. 1952 edition. 884 pages. Index. Price $3. Philadelphia, J. B. Lippincott Co., 1952.

This authoritative and reliable book is published annually. Metabolic fate, mechanism of action, uses, dosages and side effects of a large number of drugs are described. Emphasis is on new preparations, to the almost complete exclusion of many important older drugs such as, for example, morphine, acetylsalicylic acid, procaine and phenol. Obviously it is only by such selection of emphasis that the book can be kept compact enough to serve its prime purpose: to provide reliable and readily available information concerning new remedies not yet described in official compendia.

Almost one third of the book is devoted to physical and chemical specifications for drugs most of which are not described in *Pharmacopeia of the United States* or *The National Formulary*. The major portion of the book is divided into chapters, each of which consists of one or more groups of descriptive monographs. Commercial products accepted by the Council on Pharmacy and Chemistry are listed at the end of each monograph.

The information on histamine-antagonizing agents, local anti-infectives, sulfonamides, antibiotics, anticoagulants, central nervous system depressants, hormones and synthetic substitutes and skeletal muscle relaxants has been revised extensively. There has been very little alteration in the chapter on vitamins.

Among the more than 24 new monographs are descriptions of terramycin hydrochloride, acet-dia-mer sulfonamides, sodium sulfacetamide, secobarbital, thiamylal sodium, corticotropin, cyclamate calcium, hyaluronidase and three antihistamines. At least fourteen monographs which were in the 1951 edition have been omitted from this section.

New and Nonofficial Remedies differs from the major texts in pharmacology and therapeutics in three important respects. It is more up-to-date because it is revised annually. It is

more compact, partly because only the newer drugs are extensively described and partly because no effort is made to cover all of the aspects of pharmacology and therapeutics. In general, the information it contains is more reliable because of the array of highly qualified individuals who donate their services in the preparation of the book and because many errors which tend to appear in newer texts have been eliminated in the course of its forty-five or more annual revisions.

New and Nonofficial Remedies is a suitable reference and supplemental textbook for students and practitioners in dentistry, medicine and pharmacy. In order to derive the maximum benefit from the book, the latest revision should always be available. Its low cost makes a new copy each year a practical investment.

■ Chirurgie de la Face et de la Region Maxillo-Faciale (Surgery of the Face and the Maxillofacial Region). By Maurice Aubry and Charles Freidel. Second edition. 879 pages with 710 illustrations. Price 6,000 fr. Paris, Masson Editeur, 1952.

This book is dedicated to M. Virenque, with whom M. Aubry has been associated in his work on reparative surgery of the face. It is their work on plastic repair of the face which constitutes the most original part of the book. C. Freidel contributed the oral surgery section of the book.

The work, which is mostly technical, is divided into five parts:

Part I contains general considerations on anesthesia, tissue transfers and foreign material implants.

Part II is about surgery of the middle third of the face, deformities, fractures, impacted cysts, infections and tumors.

Part III follows the same plan and also includes a description of surgery of the temporomandibular joint and diseases of the salivary gland, in addition to surgery of the lower third of the face.

Part IV is about surgery of the oral cavity itself, infection and tumors. It includes a chapter on the treatment of cleft lip and cleft palate and was written by J. Recamier.

Part V deals with reconstructive surgery. It describes the emergency treatment of maxillofacial injuries, different types of lesions and procedures for repair of the damaged regions. The necessary association of surgery and prosthesis in the repair of severe injuries is well emphasized.

This book is clear, well organized and educative to the student. The trained surgeon will accept it as a most interesting contribution, for it covers the whole field of maxillofacial surgery.—*J. P. Levignac.*

■ Les Tumeurs des Maxillaires. By MM. Bataille, Beal, Bureau, Cernea, Descrozailles, Lambert, Parant. 117 pages with 12 illustrations. Price 750 francs. Paris, Masson et cie, 1952.

This brochure consists of reports delivered at pathology conferences of the Paris hospitals. Each of the eight chapters has been written by a different author. By chapter, the study includes the following topics: tumors in general, benign and malignant, by Parant; benign tumors of the jaws exclusive of cystic formation, by Lambert; cysts of dental origin, by Beal; anterior palatine cysts, by Descrozailles; adamantinomas, by Parant; malignant tumors of the maxilla, by Bureau; malignant tumors of the mandible, by Bataille; the methods of treatment and their application to oral tumors, by Cernea.

Each chapter except the final one follows a similar pattern. It deals first with the clinical aspects of the lesion, with its roentgenographic appearance and finally with its diagnosis. Chapters devoted to the study of benign tumors end with suggestive treatments. The final chapter deals exclusively with the treatments of malignant tumors.

The most important feature of the book as a reference is probably its bibliography, because most of the authors quoted are Europeans and the majority of them are French writers. The illustrations, however, are neither too significant nor too valuable.—*Rene Rochon.*

■ WHEN THE DOCTORS ARE PATIENTS. Edited by Max Pinner and Benjamin F. Miller. 364 pages. Index. Price $3.95. New York, W. W. Norton and Co., Inc., 1952.

"Seeing's believing but feeling's the truth." This old proverb keynotes the revelation of symptoms experienced by various doctors suffering from chronic disorders. It is assumed that the subjective experience of disease is more accurate than the objective. Human experience points to the contrary. Nevertheless, this series of personal experiences reveals the real feelings of the sick, their deep-seated miseries and mental sufferings. Such an insight is all the more valuable because understanding analysis and treatment of symptoms *per se* tend to be neglected in modern medicine. The patient is interested in his symptoms; the doctor in diagnosis. This series of essays bridges the gap between them.

Here the concept of symptom is greatly enlarged to mean the patient's total subjective experience caused by disease. To the commonly acknowledged symptoms such as fever, pain, fatigue and nausea are added subjective experiences on the mental, emotional, social and economic aspects of disease. There is a dual effect involved. In the one, the total personality modifies the disease and in the other, the disease modifies the personality. Both aspects must be considered in the management of disease.

In this study, there is impressive evidence that psychogenic symptoms torment the patient far more than the somatic symptoms. They may be less real than the somatic but they must be accepted on face value and treated accordingly. That means that the whole patient must be treated rather than the disease alone. Otherwise, he is bound to seek relief in pseudo-religious or fraudulent realms.

The medical contributors of these cases must have felt greatly relieved to release their three dimensional feelings on the two dimensional page, even though some use pseudonyms. The range of diseases includes heart disease, loss of sense acuity, pain, addictions, degenerative, infectious and allergic disorders and even aging.—*I. Newton Kugelmass.*

■ LE MÉCANISME DES MÂCHOIRES (The Jaws' Mechanism). By F. Ackermann. 819 pages with 721 illustrations. Index. Price 6500 Fr. Paris, Masson, 1952.

This book by Ackermann is really a book on orthopedics of the jaws. It shows a deep understanding of the physiology of jaw motion and of the unity of the whole system. It is upon that basis that principles of prosthetic rehabilitation are discussed and the author's conclusions are detailed.

The book is divided into nine parts:

Part I is on the basic principles.

Part II is a study on tooth form, the dental arch and their significance.

Part III is a study of the temporomandibular mechanism.

Part IV is on the nervous control and regulatory mechanism.

Part V is a study of levers, reflexes and deformities.

Parts VI, VII and IX are on prosthetics and the problems of mouth rehabilitation.

Part VIII is on orthopedic surgery of the temporomandibular joint. Written by Ch. Freidel of Lyon, the chapter is clear and concise, but it is not what is expected—a revision of surgical concepts based on Ackermann's work.

Other contributors to the book include Dechaume, A. J. Held, Mme. Borel-Maisonny and Psaume, Marcel Monnier and Francis de Mourgues.

This book is an excellent contribution to prosthetics and full denture work, but I also would say it goes beyond that scope and it will be read with keen interest by the oral surgeons as well as by specialists in oral pathology, orthodontics and prosthetics. The book is well printed, with good demonstrative drawings. The bibliography is also well done.—*Jacques Levignac.*

■ Relief of Pain Due to Cancer of Head and Neck. Thomas B. Douglas, Jr. GP 6:65 November 1952.

Much of the fear of cancer stems from thoughts of uncontrolled suffering. Pain produces disturbance of function in the region affected by the neoplasm. If the cancer is in the oral cavity, mastication becomes impossible, and liquids are distasteful. When the caloric intake is low, the patient's decline is rapid. Hunger and malnutrition aggravate the patient's weakness and lower his threshold of pain.

The bony foramens and the other landmarks of the skull, face and neck afford easy guides for injection of an anesthetic solution into a specific nerve or the adjacent region for the relief of pain. Major nerves of the head and the neck which supply specific regions can be injected with a 5 per cent phenol and 95 per cent alcohol solution. This solution, however, should not be employed in case of an injection near a large vessel. Two or three drops of procaine may be added; a greater concentration is contraindicated since it dilutes the alcohol and lessens its effect.

Alcohol injections should be made early in treatment or when the patient's pain is intense enough that he will not complain about the minimal discomfort of the anesthesia. Nerve blocks also are helpful when a course of roentgen therapy is to be given; for instance, in case of an intraoral tumor when pain prevents the patient from opening his mouth fully to admit a roentgen-ray cone.

Other technics provide for injections of the sphenopalatine ganglion and the inferior alveolar, lingual, glossopharyngeal, maxillary and mandibular nerves.

Additional methods which may be employed in accordance with observations made of each individual case are the surgical severance of the nerve and various treatments with roentgen rays, salicylates, barbiturates and opiates.—C. *Dean Couch, Jr.*

■ Trigeminal Neuralgia. Max M. Peet and Richard Schneider. J. Neurosurg. 9:367 July 1952.

The symptoms of trigeminal neuralgia may be relieved temporarily by alcohol injections of divisions of the gasserian ganglion or by rhizotomy. Successful treatment by rhizotomy depends not only on the surgeon's technical ability but also on an understanding referring physician and a properly enlightened patient. Physicians and patient must have in common an understanding of the postoperative problems confronting the patient such as crawling or burning paresthesias, numbness and possible anesthesia of the cornea. If there is a clear preoperative understanding, the patient with major trigeminal neuralgia will be grateful for relief from the knifelike tic pain and will accept the postoperative sensations without complaints.

In 689 cases of trigeminal rhizotomy, the age range was from 15 to 91 years. Seventy-four per cent of the patients were over fifty years old. The ratio of female to male patients was 4:3. There was an 8:5 ratio of cases involving the right side compared with those involving the left side. The ophthalmic nerve was involved in 30.1 per cent of the cases, the maxillary nerve in 80.4 per cent and the mandibular nerve in 65.9 per cent.

In trigeminal rhizotomies certain complications were noted: in 25 cases hypotension occurred, in part secondary to pain and to fear stimuli—during the course of study, thiopental sodium anesthesia supplanted local anesthesia with a resultant decrease in this

complication; in 23 cases a matting of the sensory roots made identification of the divisions difficult; in 11 cases the dura adhered to the ganglion; in 2 cases the cavernous sinus caused a problem because of the adherence of the roots of the ganglion to the lateral wall of the sinus; in 3 cases there was a bony dehiscence at the base of the skull with exposure of the carotid artery; in 4 cases tumors were encountered: a meningioma on the petrous ridge, carcinomatous nodules posterior to the foramen rotundum, a true aneurysm, and carcinoma, arising in the nasopharynx, infiltrating the gasserian ganglion.

The operative mortality rate was 1.6 per cent; all but one of those who died was over 50 years of age; all but one had been troubled preoperatively with cardiac, cerebral or luetic disease.

After rhizotomy 56 per cent of the patients reported a crawling paresthesia, 30 per cent a burning paresthesia and 4 per cent a numbness. Facial paralysis was reported by 6.5 per cent, but this was not a permanent disability in any instance. Most patients are so grateful for relief from tic pain that they do not mention these symptoms unless directly questioned.

Alcohol injections, compared with trigeminal rhizotomies, are much less satisfactory. Only 15.2 per cent of the patients treated with alcohol injections reported relief from pain for more than one year, whereas there has been complete relief from tic pain in all but 5.4 per cent of the patients subjected to trigeminal rhizotomy.—*C. C. Alling.*

■ ALVEOLAR CYSTS IN CHILDREN. J. Chatellier and Miss Dionnet. Rev. de stomatol. 53:505, July 1952.

In most cases, septic necrosis of the pulp of a deciduous tooth is associated with a follicular cyst which develops under the tooth and caps the bud of the permanent tooth. The cyst should be removed with care to avoid damaging any tooth bud. A second problem will arise later, for if a cyst around a well developed tooth is removed, the chances for that tooth to erupt well and in its proper place are poor. If the tooth bud has not already developed, most probably it will form and erupt but may not take its ideal position in the arch. Of the two the former orthodontic problem is the more difficult. It is imperative to treat the deciduous tooth and if there is an alveolar cyst to save the permanent tooth.—*J. P. Levignac.*

■ CARCINOMA OF THE TONGUE. John L. Wilson and Louis G. Brizzolara. Ann. Surg. 136:964, December 1952.

Carcinoma of the tongue is generally recognized as an extremely malignant neoplasm with a tendency to invade locally and to metastasize early. Fifty-four cases of carcinoma of the tongue were treated more than five years ago by irradiation, radical surgery or both, according to the individual problem.

In lesions confined to the tongue, the five-year survival rate was 57 per cent (12 out of 21 cases). When the tissue adjacent to the tongue was invaded but lymph nodes were not involved, the five-year survival rate was 17 per cent (1 out of 6 cases). When lymph nodes were involved, the five-year survival rate was 4 per cent (1 out of 23 cases).—*C. Dean Couch, Jr.*

■ AN EVALUATION OF PALLIATIVE SURGICAL PROCEDURES IN TRIGEMINAL NEURALGIA. Everett G. Grantham and Ludwig H. Segerberg. J. Neurosurg. 9:390 July 1952.

In many instances procedures less radical than sensory root section via the temporal route must be considered in the treatment of major trigeminal neuralgia. In the past, alcohol injections have been advocated to the neglect or exclusion of avulsion or sectioning of the peripheral nerve. The avulsion and the injection technics are considered palliative procedures.

Indications for palliative procedures on peripheral nerves are as follows: if the patients are aged or debilitated and a craniotomy would be hazardous; if the neuralgia involves only

the first division or the first and second divisions; if there is a problem of differential diagnosis between an atypical facial neuralgia and a major trigeminal neuralgia so that a palliative approach can prevent a permanent error and provide a differential diagnosis; if multiple sclerosis is causing a major trigeminal neuralgia. Palliative procedures are advisable also to avoid the complaint of patients who state that if they had comprehended the results of facial anesthesia, they would not have submitted to a rhizotomy. This complaint is less apt to be made if a palliative procedure is instituted first and is followed by a permanent procedure if pain recurs.

Even though the treatment by alcohol injections is a trying ordeal for both patient and surgeon, it is the most widely used palliative procedure. The disadvantages are the intense pain during the procedure, the high percentage of unsuccessful attempts and the occasional occurrence of facial or extraocular paralysis. One patient had loss of eyesight after alcohol injection because of the infiltration of the solution about the optic nerve.

Avulsion of the supraorbital or the infraorbital nerves is a simpler, more accurate procedure than the injection technic. It provides a more effective and lasting relief. In a number of cases, the author found that the injection technic provided relief for 15.5 months whereas the relief after avulsion was for 33.2 months. Alcohol injection should be reserved for cases where the pain is confined to the third division.

One hour after an avulsion operation, a regimen of pentobarbital sodium, 0.1 Gm.; morphine sulfate, 0.08 Gm.; and hyoscine hydrobromide 0.004 Gm. is instituted. Anesthesia is produced by infiltration with 1 per cent procaine and direct injection with 1 per cent procaine when the nerve is exposed. This method frequently produces amnesia as well as anesthesia. In addition, thiopental sodium is administered in many cases. Avulsion of the infraorbital nerve is performed by an intraoral approach to avoid an external scar. In this procedure the nerve is exposed, the peripheral end is grasped with two hemostats, and firm traction is applied to remove as much of the nerve as possible for the purpose of preventing early regrowth. The same technic is used for the peripheral end. After avulsion of the infraorbital nerve, it has been found useful to insert a needle, insulated except for 0.5 cm. at the tip, into the foramen and to apply heat from an electrosurgical apparatus until there is a charring of soft tissues. The patients are hospitalized but may be discharged in 24 to 72 hours. The regimen is supplemented with antibiotics used to provide prophylaxis.

In a group of 74 cases, there were no deaths and only one case with a complication, a mild postoperative infection after an infraorbital avulsion. When neuralgia returned, in a few cases a second avulsion was performed; but in most instances when pain recurred, a retrogasserian neurotomy was performed.—*C. C. Alling.*

■ Maxillo-facial Surgery in North America. J. Levignac. Rev. de stomatol. 53:578, July 1952.

In the United States and in Canada, maxillofacial surgery is a specialty with its own organization, courses of training, boards and societies.

In the Children's Memorial Hospital in Montreal during the past 18 months, anesthesia was used in 2,026 operations with only one death due to anesthesia.

Surgical operations for tumor by American or Canadian technics are reported in four cases of benign tumors and six cases of malignant tumors. Methods used in orthopedic and plastic surgery of the face in ten cases of fracture are described. K. H. Thoma has written a work, and many authorities have expressed their theories on fractures of the condyle. Dr. Casper M. Epsteen originated a method for wiring fractures. For cases of prognathism, R. O. Dingman has devised a method of ostectomy; and Ernst J. W. Gerrie has developed an intraoral method. Both of these procedures have the advantage of not disturbing muscular balance and of effecting a permanent result. For secondary repair of cleft lip associated with nose deformities, the Estlander-Abbe method has been used. In one case of ankylosis, after the ankylosis itself

was treated, the facial contour was corrected by homogenous cartilage graft. O. T. Stuteville has developed a concept and a method of treatment for osteomyelitis of the jaws.

The author, on the basis of his four years' experience in the United States and Canada, pays tribute to the technical ability, the efficiency and the scientific spirit of the surgeons with whom he worked at the Cook County Hospital in Chicago and at the Montreal General Hospital.—*J. P. Levignac.*

■ DIAGNOSIS AND TREATMENT OF BENIGN AND MALIGNANT TUMORS OF THE JAWS AND FACE. M. A. Lindemann. Rev. de stomatol. 53:568, July 1952.

The following tumors were reported in connection with six cases of metastatic tumors of the jaws: adenocarcinoma of the mammary gland; adenocarcinoma of the prostate; melanosarcoma, the primary appearance of which was in the temporal region; carcinoma of the lip, for which an operation had been performed six years before; carcinoma developing in the condyle three years after an identical tumor had been removed from the maxilla with no recurrence *in situ;* a hypernephroma. In a seventh case, a mixed cell tumor of the lip appeared six years after a mixed cell tumor of the parotid gland had been removed with no recurrence *in situ.* Mixed cell tumors of the parotid gland have been known to reappear also in the soft and hard palates.—*J. P. Levignac.*

■ MAXILLOFACIAL SURGERY. Casper M. Epsteen and Reed O. Dingman. Am. J. Surg. 83:613, May, 1952.

It is an undeniable fact that no surgical specialist can separate the study of his specialty from a consideration of the patient's general physical condition. A rather large group of doctors trained in both medicine and dentistry have taken a keen interest in the surgical problems of the maxillofacial region. These men by virtue of a specialized knowledge of the surgical problems of the face and jaws are especially well qualified to treat pathologic and traumatic conditions of this region. The combined medical, surgical and dental experience of such an individual gives him an over-all perspective of facial problems, impossible to realize from the combined opinions of several individuals trained in the separate fields. Congenital, developmental, traumatic and neoplastic conditions involving the face and jaws should be treated by the specialist who can offer the patient the greatest opportunity for complete recovery or for maximum improvement.

This obligation insofar as the maxillofacial area is concerned generally can be best fulfilled by the maxillofacial surgeon. This new field of endeavor, requiring two years of training in general surgery and two years in special maxillofacial and plastic surgery after completion of studies in dentistry and medicine, has been recognized by the American College of Surgeons and the American Medical Association as an important surgical specialty capable of rendering a very real and specific service to the patient.—*Herbert J. Bloom.*

■ THE USE OF HYALURONIDASE WITH TOPICAL ANESTHESIA FOR ENDOTRACHEAL INTUBATION. W. S. Howland and E. M. Papper. Anesthesiology 12:688, November, 1951.

Hyaluronidase added to 2 per cent tetracaine hydrochloride shortens the time required for the onset of topical anesthesia in the respiratory tract by 40 per cent and also decreases the total dose to a significant degree. It is suggested that the reduction of dose of tetracaine hydrochloride in this manner may be an increased safety factor in topical anesthesia. The mechanism by which hyaluronidase achieves the effects which were observed is open to speculation. It is suggested as a possible explanation that the ease of onset of anesthesia with smaller anesthetic doses may be associated with the dissolution of mucus by hyaluronidase, thus exposing the mucosal surfaces more readily to the action of the topical anesthetic agent. A simple method for obtaining good topical anesthesia of the larynx and trachea is described.—*J. K. Paul.*

Announcements

■ American Board of Oral Surgery Announces October Meeting, Examinations

The American Board of Oral Surgery will hold its annual meeting and examination of candidates October 17-21 at the Shamrock Hotel, Houston, Texas.

Information may be obtained by writing to Leslie M. FitzGerald, secretary of the Board, 718 Roshek Building, Dubuque, Iowa.

■ American Board of Oral Pathology Announces Certification Examinations

Examinations for certification by the American Board of Oral Pathology will be held from 9 A.M. to 5 P.M. September 27 at the Institute of Pathology, Western Reserve University, Cleveland, it has been announced by Donald A. Kerr of Ann Arbor, Mich., president.

Inquiries may be addressed to Paul E. Boyle, secretary-treasurer, 4001 Spruce Street, Philadelphia 4, Pa.

■ American Dental Association to Meet September 28-October 1

The American Dental Association will hold its ninety-fourth annual session September 29-October 1 in Cleveland. Three general meetings of all scientific sections will feature panel discussions entitled "Is There a Therapeutic Dentifrice?" "Newer Anesthetics of Interest to the General Practitioner" and "Denture Service for Your Patient."

The Association's Board of Trustees and House of Delegates will convene for official business meetings and elections.

■ Italian Dental Congress Announced

The twenty-eighth Italian Congress of Stomatology, sponsored by the Italian Dental Association (A.M.D.I.), will be held October 13-17 in Bari, Italy.

Three main topics to be discussed at the Congress are focal dental infection, the economic and social problems arising from dental caries, and fixed prosthesis. An international exhibition of dental equipment will be held in conjunction with the Congress.

Further details may be obtained by writing to Congresso Italiano di Stomatologia, Palazzo Ateneo, Bari, Italy.

■ Fédération Dentaire Internationale to Meet in Oslo

A symposium on sugar and dental caries will be a highlight of the 1953 meeting of the Fédération Dentaire Internationale, to be held July 26-August 1 in Oslo, Norway. Leading dental scientists of the Scandinavian countries will participate in the symposium July 28.

Other open meetings will include a discussion on collaboration between civil and military authorities concerning the organization of dental health care, a panel discussion on fluoridation and a report on public dental services. Business meetings of all commissions will be held.

Chairman of the meeting is Olaf Grythe, 17 Incognitogatan, Oslo, Norway.

■ Two-Year Course in Basic Sciences to Be Offered by University of Illinois College of Dentistry

The department of oral and maxillofacial surgery at the University of Illinois is now accepting applications for a two-year course in the basic sciences which will begin September 1953. The course, offered on a full-time postgraduate and graduate basis, will carry credit toward a Master of Science degree.

Information and application forms may be obtained from the department of oral and maxillofacial surgery, College of Dentistry, University of Illinois, 808 South Wood Street, Chicago 12.

■ Fédération Dentaire Internationale, Through International Dental Journal, Reports on World Dentistry

International Dental Journal, quarterly publication of the Fédération Dentaire Internationale, is being offered to dentists in the United States for a yearly subscription fee of $8.50. Edited by Professor H. H. Stones of the University of Liverpool, the publication contains reports from all over the world on dental research projects, trends, new developments and activities.

Subscriptions may be placed with British Publications, Inc., 30 East 60th Street, New York 22.

■ University of Minnesota Announces Graduate Program

Graduate study programs of 2-3 years, leading to the degree of master of science, are now being arranged by the University of Minnesota. A program may be arranged with a major in oral surgery, oral pathology, orthodontics, oral medicine, periodontics or restorative dentistry (operative, prosthetics, pedodontics or endodontics) and a minor in one of the fundamental health sciences.

An alternate program in the basic sciences, with special reference to dentistry, leads to the doctor of philosophy degree.

A limited number of fellowships and teaching assistantships are available to the graduate students. Stipends for these appointments range up to $3,600 per year. Further information and application forms may be obtained from the dean of the Graduate School, University of Minnesota, Minneapolis.

■ American Society of Oral Surgeons to Meet October 21-24 in Houston, Texas

The thirty-fifth annual meeting of the American Society of Oral Surgeons will be held October 21-24 at the Shamrock Hotel, Houston, Texas. Examination of candidates for membership will be held October 17-21. Candidates appearing for examination are eligible to attend the meeting.

Registration of members and candidates will begin Wednesday, October 21, when the exhibit will be opened. The first general session will begin at 9:30 a.m. Thursday, October 22.

Application forms for membership in the American Society of Oral Surgeons may be obtained by writing to Miss Ruth F. Whalen, executive secretary, 1112 East Clay Street, Richmond 19, Va. Applications to be presented at the Houston meeting should be filed with the executive secretary well in advance of the meeting date.

Editorial communications

■ ORIGINAL COMMUNICATIONS—This journal invites concise original contributions in the broad field of clinical and experimental surgery of the mouth and associated structures, including roentgenology, diagnosis, anesthesia and oral surgical pathology. Articles are accepted for publication with the understanding that they are contributed solely to the JOURNAL OF ORAL SURGERY. All manuscripts are subject to editorial modification. Neither the editors nor the publishers accept responsibility for the views and statements of authors expressed in their communications.

■ MANUSCRIPTS—Manuscripts submitted for publication should be sent to Fred A. Henny, Editor, Henry Ford Hospital, Detroit, Michigan.

Manuscripts should be typewritten on one side of the paper only with double spacing and liberal margins. The author's name and the abbreviated title of the article should appear at the top of each manuscript page. The original should be sent to the editor and a carbon copy retained by the author. Manuscripts will not be returned if accepted for publication.

References should be placed at the end of the article and should conform to the style of the Quarterly Cumulative Index Medicus; viz., name of author, title of article and name of periodical with volume, pages, month and year. They should be numbered and should appear in the same order as that of the superior figures inserted in the appropriate positions in the text.

■ ILLUSTRATIONS—Illustrations accompanying manuscripts should be unmounted and numbered. The author's name should appear on the margin or back.

Authors should insert figure numbers at appropriate places in the text. The original drawings, or glossy print photographs of them, should accompany the manuscript. Legends for illustrations are to be typewritten in a separate list with numbers corresponding to those on the photographs and drawings.

A reasonable number of halftone illustrations will be reproduced free of cost to the author, but special arrangements must be made with the editors for color plates, elaborate tables or extra illustrations. Copy for zinc cuts (such as pen drawings and charts) should be drawn and lettered in India ink or with black typewriter ribbon (carbon paper placed with carbon against back of sheet for bolder type). Ordinary blue or colors will not reproduce. Only good photographic prints or drawings should be supplied for halftone work.

■ CASE REPORTS—Case reports will constitute an important department of the journal and the editors welcome case reports that are of unusual clinical value or that present exceptional conditions of interest to dental surgeons.

■ EXCHANGES—Letters, exchanges, reprints and all other communications relating to the JOURNAL OF ORAL SURGERY should be sent to the American Dental Association, 222 East Superior Street, Chicago 11.

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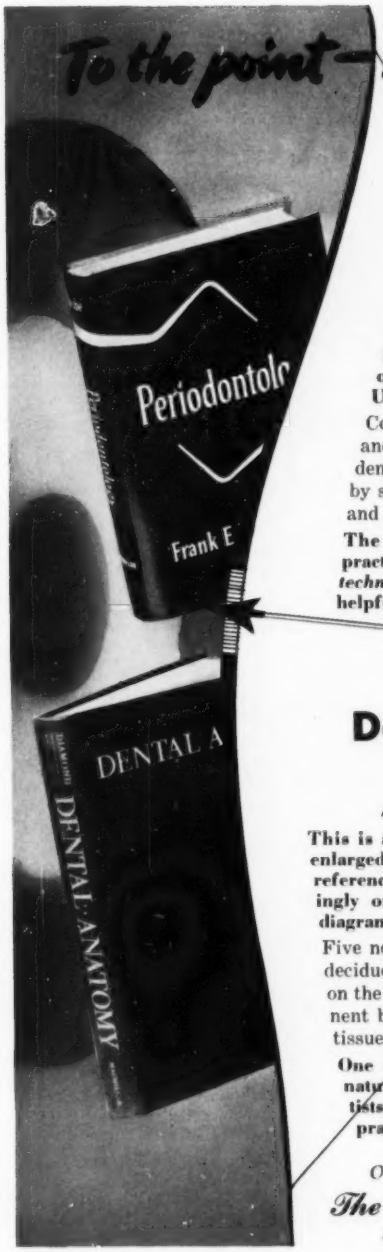

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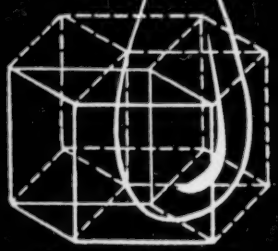

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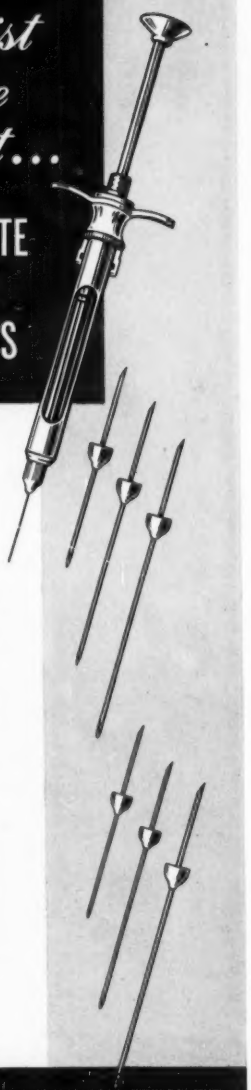

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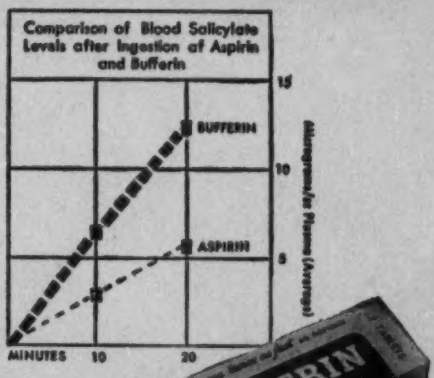

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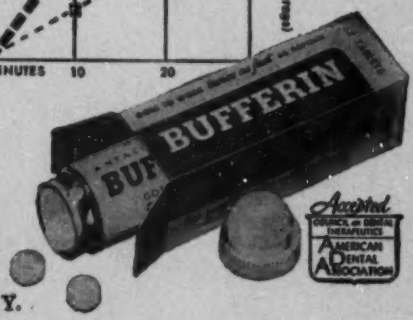

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